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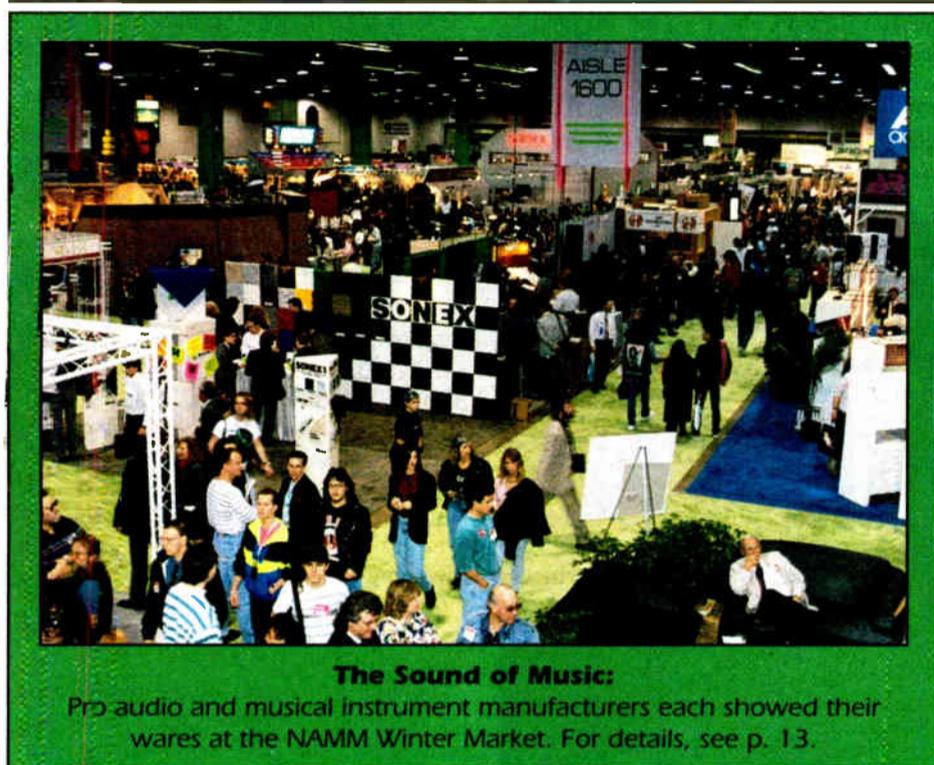
Radio World

Build a 1Watt
Amp for a Buck,
p. 33

Vol 17, No 5

Radio's Best Read Newspaper

March 10, 1993



The Sound of Music:

Pro audio and musical instrument manufacturers each showed their wares at the NAMM Winter Market. For details, see p. 13.

Interim FCC Chairman Named

WASHINGTON Although changes have been made at the FCC's highest levels, the selection of a permanent replacement for former Chairman Al Sikes is not among them.

Veteran Commissioner James Quello was tapped as the interim Chairman of the FCC in mid-February, succeeding Sikes, who exited the post Jan. 19. Commissioner Sherrie Marshall, who has continued to serve past the expiration of her term on June 30, 1992, has requested not to participate in any FCC broadcast or cable proceedings. Marshall is rumored to be headed for the D.C. law firm of Latham & Watkins.

In a prepared statement, NAB President and CEO Eddie Fritts praised Quello's provisional selection to head the FCC. "Jim Quello will make an excellent interim chairman. We are pleased that the Commission will have strong leadership during a period when a number of impor-

tant issues, including HDTV, DAB and the Cable Act implementation, are at a crucial stage."

Quello is not a candidate for permanent appointment. His selection as interim chairman does not affect the Commission's search for a replacement for Sikes, and a number of names have

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RAB-MSA Highlights Creative Management

by Lucia Cobo

DALLAS The Radio Advertising Bureau's 13th annual Managing Sales Conference (MSC) drew a record crowd of 1,576 radio managers and sales executives to the Loews Anatole Hotel. The MSC, held in Dallas Feb. 4-7, centered around the theme, "Managing Out of the Box." The RAB designed workshops, forums and keynote addresses were all targeted to challenge the old ways of doing business.

News from the U.K.

Two managers from the U.K.'s successful Metro Radio Group shared techniques they have developed over four years of revenue gains averaging approximately 20 percent per year. According to Metro Radio, the secret to success is a "creative-led sell" in which the radio creative becomes the driving force behind bringing new clients into radio.

Metro Radio's presentation revealed that 30 percent of the station's sales staff, or 25 of the 85 sales executives, are dedicated copywriters and producers. Radio creative is developed and scripts presented before the schedule size and

budget are even discussed.

Other sessions included the "Executive Symposium," an exclusive session limited to the first 200 managers registered. The session was taught by NewCity Communications President/CEO Richard Ferguson, and Bill Moyes, chairman and CEO of The Research Group.

The session was designed to prepare managers for the changes in electronic communications. Attendees learned techniques in broadcast strategic problem solving and corporate survival tactics. Oren Harari, a senior consultant with the Tom Peters Group, presented "Cutting Edge Services: Creating a Customer-Obsessed Organization." Harari discussed his view that today's chaotic business world demands bold and radical approaches to management.

Nancy Friedman led a forum on telephone "do's and don'ts." Friedman and her husband developed a customer service department while operating their own radio stations. That concept has evolved into "The Telephone Doctor," a system to improve sales and service over the telephone.

Creative personalities Dick Orkin (of Orkin's Radio Ranch and Home for Wayward Cowboys) and Chuck Blore (Chuck Blore & Co.) along with Barbara Goldman, vice president and senior radio producer, Backer Spielvogel Bates, New York, discussed the nuts and bolts of what makes good radio creative—what sells and what doesn't.

Keynotes

RAB President Gary Fries led the opening session of the MSC with his 1993 "state of the industry" address.

CBS Radio's Charles Osgood delivered a message of optimism and belief in the business to fellow broadcasters. Osgood told his audience that no other medium can match the warmth, presence or imaginative potential of radio and its relationship with its listeners.

Tapping retail dollars successfully is essential to radio's survival. Two retail experts, Paul Leblang, former senior vice president and director of marketing for Saks Fifth Avenue Department Store, and Fred Newell, president, Seklemian & Newell, and former CEO of Rhodes Southwest Department Stores, described ways they felt could make radio a permanent major medium for retailing in the coming years. In the forefront of their discussion, Newell and Leblang talked about database marketing and how stations can utilize this tool to generate retail revenue.

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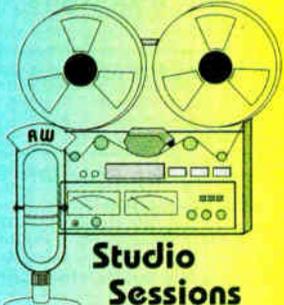
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Studio Sessions

Equipment and Applications for Radio Production and Recording, pp. 13-20

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World Radio History

NEWSWATCH

EIA Delays DAR Hardware Testing

WASHINGTON The Electronic Industries Association (EIA) Digital Audio Radio Committee has delayed its digital audio radio systems testing schedule by nearly three months.

The original schedule called upon all proponents to submit hardware to the DAR Subcommittee by April 15. The revised schedule is now July 1.

Gary Shapiro, the EIA's Consumer Electronics Group vice president, said the original schedule always had some

flexibility built in. "The revised time line allows proponents more time to complete their system's development, and gives the subcommittee more time to complete the testing and secure a testing site," he said.

As of early February, no site had been finalized, and much of the testing equipment had yet to be secured.

Five system proposals have been submitted: AT&T Bell Laboratories, Thomson Consumer Electronics (EUREKA 147), Amati Communications, NASA/VOA and Jerrold Communications.

Although the EIA has completed

numerous technical standards and has ample resources for such processes, the digital audio radio issue has been highly controversial.

One of the publicized DAR system proposals, USA Digital's Project Acorn, recently pulled out of testing. The consortium of Gannett, Group W and CBS is working on an in-band, on-channel transmission for AM and FM, but decided to pull out because of what it called "broadcaster concerns."

The NAB also is pressuring EIA to relinquish testing of all in-band systems to the National Radio Systems

Committee (NRSC), a joint EIA/NAB industry standards-making group.

RCS Acquires Decision

SCARSDALE, N.Y. Radio software company Radio Computing Services Inc. (RCS) recently acquired the assets of Decision Inc., a Texas firm that specializes in traffic and news systems for radio stations.

Decision employees will become RCS employees; Decision President Bill Waller becomes RCS's vice president.

Decision's original product, Broadcast Systems III, will now be called RCS Traffic.

Law Would Release Spectrum

WASHINGTON A congressional bill (H.R. 707) introduced into Congress Feb. 8 would release 200 MHz of spectrum into the private sector, but require up to 30 MHz of the spectrum to be allocated by competitive bidding or auctions.

According to bill sponsors, the competitive bidding would be used for "some frequency assignment," initially in 1994, but if the effort is successful, the FCC may begin general use of the new process on Oct. 1, 1997.

Though supportive of the reallocation of spectrum from government to the private sector, the NAB opposes any spectrum auctioning. "The assignment of broadcasters should be determined by sound public policy, not who has the most money," the NAB said.

continued on next page ►

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FBI: On The Radio

WASHINGTON ABC Radio has broadcast more than 125 installments of "FBI, This Week," a weekly, one-minute, public affairs service highlighting the FBI's cases.

Since September 1990, each program has featured information on FBI-related topics and cases, investigation techniques and other issues the agency becomes involved with. The show also sheds light on the capture of criminals and the solving of a variety of cases, according to the FBI.

"We're excited and think the public will enjoy this inside look at the FBI," said Kent Coughlin, senior vice president, engineering and program operations at ABC Radio.

French IDAT Debuts

CANNES, France IDB Communications Group introduced the France IDAT (International Digital Audio Transmission) service during the recent MIDEM Convention.

The Los Angeles-based KIIS-FM Rick Dees Morning Show was broadcast from the convention on IDB's 15 kHz digital signal. It was transmitted from Cannes to France Telecom in Paris where it was uplinked to Intelsat 307. The signal then was downlinked to IDB's International Teleport in Staten Island, N.Y. and transmitted via satellite to Los Angeles and then landlined to KIIS-FM.

EBS Testing to Begin

WASHINGTON The FCC will be field testing the proposed replacements for the current Emergency Broadcasting System (EBS) technology over the next several months, based on the mandate from recently released dockets 91-301 and 91-171.

"The tests are being conducted to assure that the proposed new standards will be compatible with all technologies that deliver emergency alert information. We are recommending that several tests be conducted with at least one test in the East and one in the West of the U.S.," the FCC said.

The FCC also invites all interested equipment manufacturers, cable, broadcast stations and other parties to participate in the tests. For more information, contact EBS staff at 202-632-3906.

Armed Forces to Carry USA Radio Network

DALLAS As of February 15, The Armed Forces Radio Network began broadcasting USA Radio Network news and sports programs.

Already heard on 1,000 stations nationally, USA Radio Network will now be heard worldwide with the Armed Forces Radio Network as an affiliate.

Henry Engineering Re-Issues FastTrac

SIERRA MADRE, Calif. Henry Engineering has announced the availability of a limited number of the company's FastTrac dubbing systems.

The FastTrac was introduced approximately four years ago as a convenient system for dubbing records to cart. Because of the declining use of vinyl product in radio, the device was discontinued in mid-1992.

Now, according to Henry Engineering President Hank Landsberg, an order has been placed by a major network for a "large number" of the FastTrac systems. The order has prompted Landsberg to gear up for another production run.

Broadcasters interested in purchasing the FastTrac are encouraged to act quickly, Landsberg said. For more information, contact Henry Engineering at 818-355-3656, or telephone any authorized Henry Engineering dealer.

AM RBDS May Interfere With Wideband Receivers

by Dee McVicker

LOS ANGELES Radio listeners may have to compromise wideband reception beyond 8 kHz in order to utilize an AM version of RBDS (Radio Broadcast Data System), according to recent engineering tests.

Potential interference problems on wideband AM was one of several findings submitted to the National Radio Systems Committee (NRSC) at the Winter Consumer Electronics Show (WCES) in January. It was the NRSC's first status report concerning a dynamic AM RDS system, submitted to the RBDS subcommittee.

Prepared by Los Angeles-based independent engineer Richard W. Burden of Burden Associates, the report summarized transmission tests of Real Time Designs' proposed AM RBDS system.

Testing was done by Burden at a Los Angeles AM station and included modulating tones within the AM RF mask to determine audible effects. Pairs of 9 kHz to 11 kHz tones set 600 Hz apart were modulated on and off alternately to create a digital data stream.

Although the preliminary tests indicated that the two-tone system might be a problem for wideband AM reception, they show promise of transmitting RBDS

on AM for dynamic broadcast of formats, traffic alerts and other RBDS information. Based on the report, NAB Director of Technical Regulatory Affairs John Marino said, "the committee has been encouraging them (Real Time Designs) to proceed."

Working on a prototype

Since the tests, development has progressed for an RBDS receiver device to extract the AM data stream, according to Robert C. Copriviza, director of engineering for Real Time Designs Inc. of Los Angeles, Calif. Real Time Designs has developed similar devices for similar applications and expects to have a prototype device for AM RBDS reception available soon.

Following the availability of this device, further testing is required to determine whether the system will be an effective and affordable alternative for AM.

The recent report is the first to document field tests of the system since Real Time Designs submitted its proposal in May 1992, and follows on the heels of the NRSC subcommittee's acceptance of an RBDS standard for FM.

Conducted in Los Angeles at Greater Media's KRLA-AM on 1110 kHz, the

continued on page 7 ▶

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Saying Goodbye After Seven Years

by Alex Zavistovich

WASHINGTON You know, a lot can happen in seven years. For example, seven years ago, AM stereo was still a reasonably fierce competition between two key players, satellite program delivery was a big dog's game (and primarily in TV, at that), and the hottest news in transmitters was solid state design.

Seven years ago, digital audio tape was a fledgling technology that hadn't yet made it across the Big Pond, carts and LPs (remember them?) were the primary program sources, and production gear was almost exclusively splice blocks and razor blades—and for less experienced folks, Band-Aids.

Seven years ago, a computer was only a slightly more common sight at a radio station than, say, an Asian elephant, and "disk storage" meant the room where you kept your records. In the major markets, "going digital" may have meant a consumer CD player and a couple dozen discs; in the smaller markets, it usually meant the GM had just bought a new clock for the lunchroom. DAB? Yeah, right.

Seven years ago, I joined **Radio World** as a junior reporter.

★★★

I was 24, fresh from three years of working for the Navy. Before that, I had been the training director for WCWM-FM, the campus radio station for the College of William & Mary: "Radio Free Williamsburg: None of the Hits, None of the Time."

As a musician, I was exposed to a good bit of signal processing technology, the earliest home multitrack equipment, and other musical instrument innovations that still hadn't really made it on the scene in radio. So I became the "gear-head" writer at **Radio World**, tackling the more complex technical issues. As luck would have it, I always seemed to be standing around when someone above me left. Five years later, I became the editor.

Being the editor, especially around NAB spring show time, always reminds me of a line from the Grateful Dead: "I may be going to hell in a bucket, but at least I'm enjoying the ride." You may



never quite understand the phrase "deadline pressure" until you've tried to put together a 100-plus page convention preview in 10 working days. Why do we put ourselves through it? Probably, as the old joke goes, because it feels so good when it stops. (It's also our *job*, but that's beside the point.)

That's why I have somewhat mixed emotions as I find myself writing this, my last column for **Radio World**. Yep, after seven years, I'm moving on to another job outside the broadcast indus-

I'd like to think I've contributed to RW's strong foundation of credibility . . .

try. It's a golden opportunity, a natural transition from editing to publishing, and a good career move. But I'm leaving right before work begins on this year's NAB preview (the March 24 issue), and I feel a little guilty about deserting the team just as things kick into overdrive.

Of course, the publication is still in very capable hands. I'm happy to report that Lucia Cobo, who joined the team more than a year ago as managing editor, will now be running the whole show. She came

to us from **Broadcasting** magazine, where she had been one of the radio editors.

Luci's transition to editor, in turn, created a vacancy in the managing editor position. It was a vacancy that didn't take long to fill, though. I'm equally happy to report that Randy Sukow has taken over as second in command, effective March 8. Randy also comes to us from **Broadcasting**, where he had been assistant editor. He's a nine-year veteran, with a solid background in radio and TV technology. (You know, if the people at that particular industry publication had not been too familiar with **RW** before, they're definitely aware of us now. It's a cut-throat world, publishing...)

★★★

So I end this column pretty much as I began, reflecting on seven years of change. Seven years of progress, both in radio in general and this newspaper in particular.

If I've accomplished anything of value during my time here, I'd like to think I've contributed to **RW's** strong foundation of credibility, integrity, and genuine interest in the future of this medium. I'd also like to thank everyone who helped me define my own "big picture" view of the broadcast industry, and all those who had the

patience to coach me through the rapidly evolving technology of radio in the days when I couldn't tell the difference between rigid transmission line and a water pipe.

Look, I don't want to get all dewy-eyed and maudlin here. Good-byes are hard enough as it is; I sound like I'm accepting the Oscar for Best Actor. In the final analysis, I was lucky enough to hook up with a good bunch of folks who are committed to doing the best job possible with the strongest, fastest-rising publication in the industry.

Who knows—it's a small world. You may yet find me strolling the exhibit halls at the NAB spring show in Vegas some day, catching up on all I've missed while I've been away from broadcasting. And if you do, be sure to say hi. Drinks, of course, are on you.

★★★

One last bit of housekeeping: A couple issues ago, I reported that Telos Systems had acquired Cutting Edge Technologies. Apparently, some folks have been calling Telos all panicky, asking whether Frank Foti, Cutting Edge's design guru, had left or was planning on leaving the company.

The answer is a resounding "no." To quote Telos' Steve Church, "Frank Foti is still very much with the company." Everybody's happy with the way things are. In fact, if I know those two, they're probably downing a pizza somewhere together, drawing circuit diagrams on the back of a cocktail napkin. Those guys—what a pair of wildmen.

Anyway, that's it for me. Next time you tune in, another hand will be holding the rudder. Good luck, Luci; good night, Chet; good night, David. As Dennis Miller used to say, "I am *outta* here."

Alex

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Dyaxis double-take

Dear RW,
Ty Ford's recent review of the Dyaxis Lite (Jan. 6, 1993) misses many of the advantages of the Dyaxis system for use in radio. As an audio documentary producer and a contributor to public radio news-magazines, I have relied on Dyaxis' superior editing features for over three years.

In fact, the piece can hardly be considered a review at all. Rather than address how the machine actually works, Mr. Ford takes us into a facetious fantasy held by many engineers—that reporters and producers are inept at using professional equipment. To make matters worse, Mr. Ford suggests that his hypothetical user might not even have the sense to read the manual:

"Even if she already knows how to get around on a Mac, Helen must do the MacMix tutorials and read the manual. There is no other way."

Even though the Dyaxis is easy to use, I would not consider having to read the manual a drawback—for this, or any other piece of equipment. Let's get real.

What Mr. Ford doesn't describe is the ease of use and the excellent graphic interface of the Dyaxis. The Dyaxis offers one of the most intuitive editing systems on the market. The operator can zoom in on any duration of a sound file with ease. Reference marks are easily placed and moved. Unwanted sounds within a segment are easily surrounded with the cursors and then deleted with a keystroke, and rough edit spots are beautifully fixed with a simple crossfade.

The system of recording takes and subsequent file management have been very well thought out, so even if you are constructing a piece with many elements, everything is easy to organize and easy to retrieve. It is true that there are some things Dyaxis Lite does do slowly, but most of these are things that the other two-track systems can't do at all. The system is intuitive and time efficient. Ultimately, the technology allows pro-

ducers and editors to focus on their ideas and to create their best work. It is too bad that Mr. Ford was unable to discuss these attributes.

Steve Rowland
Producer and Executive Producer
"The Miles Davis Radio Project"
"The Music Makers" Documentary Series
Philadelphia, Pa.

Ty Ford replies: Jeez, Steve, it sounds like there might be some bad cheese steaks going around up there in Philly.

First, you couldn't have been using the Dyaxis Lite for three years, because it's a new configuration. According to Studer Editech's Rick Evans, unlike the Dyaxis, the Lite doesn't have any DSP functions or external time code capability. In a recent call, Rick did mention that time scaling is possible with Alchemy, a third-party software from Passport or Soundhack, freeware which he said is available from someone at Mills College in Oakland, Calif.

If you think I took you into a "facetious fantasy," you are mistaken. What I did was present, in allegorical form, a step-by-step account of what it would take to get a newscast on the air. Sorry you didn't like the style. I also cited specific examples of problems that can be encountered with the system, and explained how to avoid them. Most people, including engineers, like that kind of problem-solving information.

I'm not even close to suggesting that the user might not have the sense to use the manual. I also never said that reading the manual was a drawback. I'm telling the reader straight out that the Dyaxis Lite is not intuitive enough to be operated without using the manual.

I talk to professional audio people everyday who have looked at and worked with many systems. They are tremendously put off by the amount of computer technology one must suffer through to get the job done. I also spend a good portion of my time on the phone with workstation manufacturers discussing ways to improve the performance and reduce the technology between the audio and the operator.

I am an advocate of workstations, and a user. Have we made progress? Yes we have. The second part of my article on the Korg SoundLink, which appears in this issue, is proof of it. Do we have farther to go? Indeed we do.

The bottom line is, my responsibility is to the reader. That means providing a balanced account of my findings.

Questioning fines

Dear RW,
After reading numerous stories about FCC fines and other enforcement actions in various industry publications, one must wonder about several things:

- 1) What ever happened to due process in this country?
- 2) Has the FCC ever heard of the Constitution?

Historically, a person accused of committing an offense was presumed innocent until proven guilty in a court of law. If proven guilty, that court then issued the appropriate penalty. But with the FCC and certain of our other federal agencies,

The recent appointment of long-time FCC Commissioner James Quello to the position of interim chairman provides an opportunity to re-evaluate the criteria on which the selection of a chairman is based.

It Is Time For Change

and the FCC — previous appointments to the chairmanship have generally had more to do with political recognition than knowledge of broadcasting.

Granted, a political or legal background is helpful in navigating the murky waters of special interests that are at the heart of many dockets before the Commission. However, it is likely that a broadcaster would have a greater understanding of the ramifications of regulatory policy on the future of the industry than even the most well-advised politician.

Quello, and whomever his permanent successor might be, are inheriting a difficult job. Aside from issues that indirectly affect broadcasters (cable reregulation and the financial-syndication rules), the FCC has undertaken an examination of the emergency broadcast system, a pending Notice of Inquiry on digital audio broadcasting (DAB), and will be taking action on applications for satellite DAB.

Action by the Commission must be taken soon on these issues, and a broadcaster's perspective in the Chairman's seat would be beneficial to the industry.

The recent record-breaking attendance at the RAB Managing Sales Conference (all day SRO sessions packed with hundreds of determined sales managers), and the positive attitudes displayed by all who attended, indicate that the industry is on the road to better health. This is good news and indicates that broadcasters will have the financial ability to keep pace with the research and technological innovations demanded by the issues currently before the Commission.

The delay by the Executive Branch in appointing a permanent successor to former Chairman Sikes is an opportunity. National representatives must be lobbied to bring pressure to bear on the administration to appoint someone with a broadcast background to the permanent Chairman's seat.

—RW

one is presumed guilty and must prove himself innocent—not in a court of law, but before a hearing examiner. And the FCC can, without recourse to the courts, levy fines sufficient to put many smaller broadcasters out of business. The FCC has even been fining people who are themselves not directly responsible.

A publication by the American Radio Relay League, an amateur radio organization, ran a story about several ham radio operators who were fined up to \$2,000 each for tower light violations. Their offense: They rented space on commercial radio towers for their VHF repeaters. Since when is a tenant held responsible for violations committed by an irresponsible landlord? Perhaps, using the FCC's example, the FAA can start fining passengers in an airplane whose

pilot was accused of an infraction?

Then there is the indecency matter. If indecent speech can be restricted in the first place, why are stations being hit with whopping fines for indecent broadcasts, while no action is being taken at all against the garbage-mouth DJs who have precipitated the whole matter? And why are these FCC rules being enforced selectively? While the Commission has been going after Infinity Broadcasting with a vengeance because of remarks made on the Howard Stern Show, no action at all has been taken against TV stations, networks, and producers who broadcast material in prime time (or during the day, well outside the "safe harbor") that is equally offensive.

Name withheld by request
West Creek, N.J.

GUEST COMMENTARY

Remembering Jim Shelton

by Art Vuolo, Jr.

INDIANAPOLIS In every radio market there is a name that everybody knows. In New York, it might be Cousin Brucie or Dan Ingram. In Los Angeles perhaps it is Gary Owens or the Real Don Steal. Chicago will never forget Dick Biondi or Wally Philips. In Indianapolis, it was Jim Shelton.

Those of you who know me realize my passion for radio is very intense. It was Jim Shelton who lit the fire that still burns within me about the radio industry, and it was he who instilled the in me the radio "bug" back in 1959.

Jim Shelton died February 11th of heart failure while vacationing in Mexico. He was with his wife Dorothy at the time. In his unprecedented 50 years at one radio station (WIBC), he never missed a day of work due to illness. Certainly a record which might never be broken.

Jim, a Cincinnati native, was the most listened to air personality in central Indiana in the 1960s. He did three programs each weekday on the 50,000 Watt WIBC. They were: "Pick-a-Pocket," a daily live quiz show set in downtown Indianapolis airing at 12:15 p.m., and rated number one for 22 years; "Tel-O-Test," a telephone quiz show that aired at 6:45 p.m., five nights a week and preceding his popular "Platter Party Top 40" show. Each night Jim would do a remote from a different car dealership, selling Fords one night and Chevys the next—with total conviction.

Ironically, Jim died at the age of 73, a number which in "radio code" means farewell or goodbye. I, for one, owe whatever successes I have enjoyed or achieved to this gentle man who may be gone, but whose spirit and whose radio signal will live on forever.

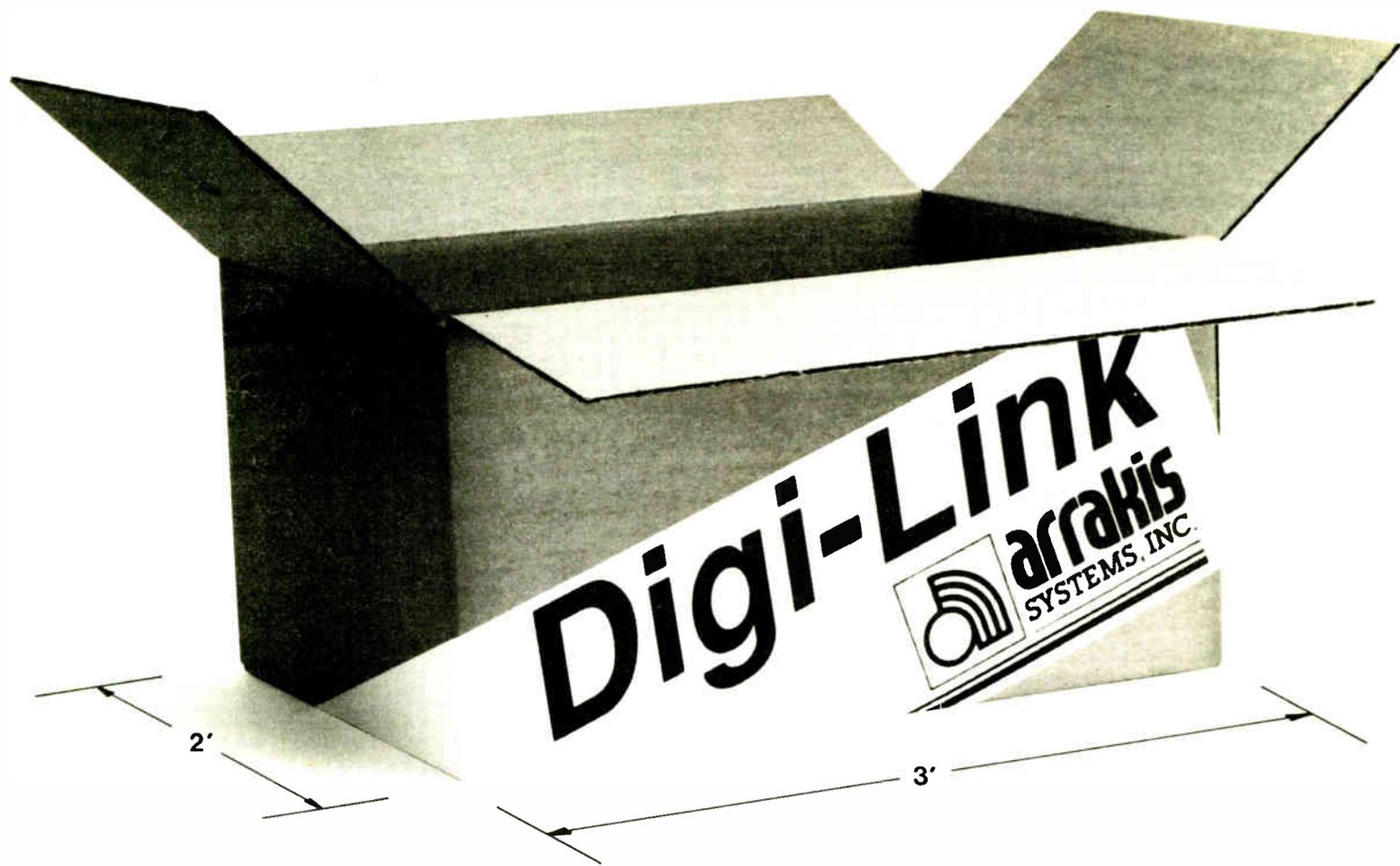


Voll. 17, No 5 March 10, 1993

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Next Issue of Radio World March 24, 1993



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AM RBDS Hurts Wideband Reception

► continued from page 3

tests concentrated on the audibility of tones in the 9 Hz to 11 kHz spectrum as monitored on AM receivers. Tones at various levels, 25 to 35 dB below 100 percent as referenced to 400 Hz, were inserted into the broadcast chain following the station's audio processing and were paired at 9.2 kHz and 9.8 kHz, 9.7 kHz and 10.3 kHz, and 10.2 kHz and 10.8 kHz.

A Belar AM preamplifier and monitor were used at the reception point for reference measurements; a Denon TU-680 AMAX tuner connected to a whip-type roof antenna and wideband amplifier was used on the receive end.

Interference detected

The first set of tests was made during nighttime hours, with the tuner set in wideband mode, flat to 10 kHz. A noticeable first adjacent channel carrier beat at 12 dB down from 100 percent modulation, however, impaired reception and the tests.

Moreover, Burden noticed several first adjacent carrier beats with the NAB TU-680 receiver set in wideband mode. Burden wrote in the report that "the measured field was 2.3 mV/m and that tuning around the band we noticed a number of 1st adjacent carrier beats." One in particular was observed at about five miles distant and placed a 20 mV/m nighttime signal at the receiver site in Canoga Park, Calif.

At the expense of some audio quality, reception was then tested with the NAB TU-680 receiver set in its narrower bandpass position by enabling its notch filter at around 10 kHz. Burden reported

favorable listening on the AMAX receiver, as well as favorable listening on a '60s vintage MacIntosh MR-66 tuner with its 10 kHz notch filter also engaged.

These observations, Burden said, typify nighttime AM reception in many areas across the nation. Whether or not RBDS tones in the 9 Hz to 11 kHz spectrum are

The recent report is the first to document field tests of the AM RBDS system.

audible will be of no significance to listeners who disable wideband reception on new AMAX receivers during nighttime listening, he explained.

Although the tests indicate that the tones could be audible on some wideband AM receivers, Marino said that this probability is not likely to be a problem since these radios can be user-selected for more narrowband reception.

"It's not a situation where you have to trade one for the other," he said. "It seems it would be very easy to transmit the data and also have wideband radios."

Copriviza added that the majority of AM radios today are narrowband and would not be affected by the RBDS transmission method.

Guardband proposed

In the next set of tests conducted, tones were introduced during normal broadcast hours at 25, 30 and 35 dB down. "These test tones," according to Burden, "were audible on the Denon tuner with the exception of the 10.2 and 10.8 pair at -35."

In conclusion, he wrote, "introducing a guardband between channels, as there is in FM, by restricting the audible spectrum to 8 kHz, might result in an audible plus."

Follow up tests of the proposed RBDS system for AM are expected to be conducted by mid-1993, including reception and extraction of the data stream on a modified RBDS receiver. A prototype decoder device is currently in the works at Real Time Designs to extract and interpret the data stream and to hand off this signal to an RBDS decoder.

Copriviza, who is designing the prototype, is hopeful that the final AM RBDS device will have enough capability to take on much of the AM reception functions. If so, he said, this will keep component costs down for receiver manufacturers wanting to implement dynamic AM RBDS in their receivers.

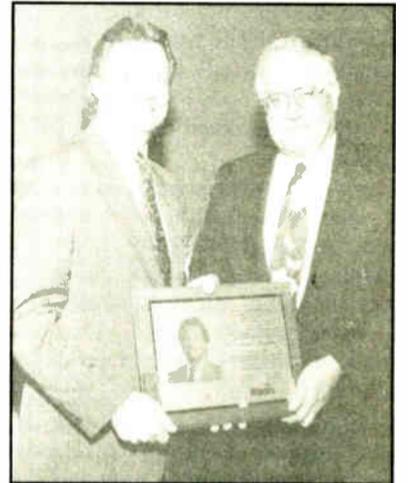
The Real Time Designs' proposal falls under the RBDS standard's Section 5, according to the NAB's Marino, which has been left open in anticipation of a dynamic AM RBDS scheme. Section 4 of the standard provides for another AM technology, ID Logic B, which is deemed as a less dynamic alternative for AM participation in RBDS.

Unlike FM RBDS which is a broadcaster subcarrier, ID Logic B is an in-receiver database technology, licensed by PRS Corporation, that stores station ID and format information in the receiver.

Creativity Key Focus At '93 RAB-MSA Show

► continued from page 1

A well-attended keynote address was Mimi Donaldson's "How Women Think." Donaldson is a management and training development specialist who discussed some key differences between the way men and women think and communicate.



RAB President and CEO Gary Fries (r) presented a plaque to Beck-Ross Communication's Jim Champlin, MSC Chairman, in appreciation for his involvement with the show.

Interim FCC Chairman Named

► continued from page 1

repeatedly turned up as likely contenders for the position. Besides Senate staffer Toni Cook, other names have emerged as front runners, including Washington lawyers Lew Paper and Reed Hundt.

At press time, no information was available regarding a permanent successor to Quello, a replacement for Marshall, or when either of those posts would be filled. Quello presided over his first open FCC meeting in February.

The 78-year old Quello was first appointed to the FCC in 1974. He had been, up to that point, the long-time manager of Capital Cities' WJR-AM-FM in Detroit. He originally joined the station in 1947. Quello was born in Detroit.



James Quello, Interim Chairman of FCC

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KTFC Powers Transmitter With Wind-Generated AC

Station Saves About \$1,000 on Monthly Power Bill With Updated Version of Old-Fashioned Technology

by John Gatski

SIoux CITY, Iowa A windmill may look normal on a midwest farm, but what if it's on a radio station?

Don Swanson, owner of KTFC-FM, believes his recently installed windmill fits right in at his religious station—especially when it is saving him almost \$1,000 a month on his \$1,500 power bill. "I wanted to cut down on my expenses," Swanson said.

The wind-powered generator system can generate as much as 65 kilowatts of power. Although it works on the same principle as windmills of one hundred or more years ago, KTFC's model sports modern technology.

The unit's blades are 25 feet long and made of fiberglass. It boasts an 8,000-pound turbine with a six-inch steel shaft for durability.

The wind generator is mounted on an 80-foot tower next to the station. The tower is 24 feet by 24 feet, with 30-inch-thick supports.

The blade rotor is automatically adjusted by computer to rotate the blades toward the wind. Swanson said he bought the

used windmill generator from a "windmill farm" in Arizona. The unit was manufactured in Denmark by Windmatic.

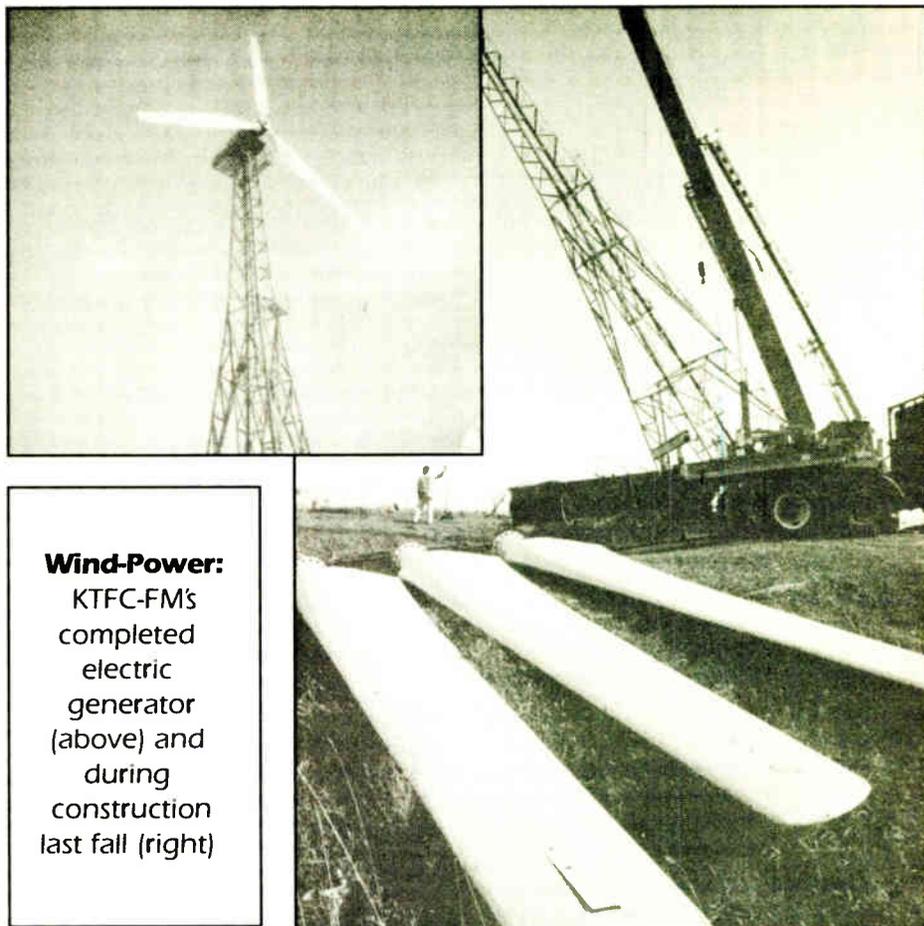
Swanson said he is always looking for ways to cut the costs of his station's power consumption. One day last year, an acquaintance told him about a trip to Arizona. "A friend of mine was out in that (Arizona) valley where they have 4,000 of them."

Similar capacity wind-powered generators are about \$105,000, Swanson explained, but he said was able to negotiate a "good deal" on KTFC's unit.

The turbine will produce 1.3 kilowatts (1.3 kW) of electricity with wind speeds as low as six miles per hour (6 mph), and will generate its maximum 65 kW at 30 mph or higher wind speeds, according to Swanson. At maximum wind speeds, the blade rotor turns at about 85 mph.

Where the station is located, the average wind speed is about 15 mph, but "on calm days, we don't get anything," Swanson said. On the wind-free days, KTFC has to rely on the power company, he added.

The wind generator also produces an extra benefit—based on the federal rural



Wind-Power:

KTFC-FM's completed electric generator (above) and during construction last fall (right)

electrification program—extra power to the community. Power electric cooperatives buy excess power generated by third parties.

The KTFC installation took about two months, and went smoothly, despite the technology being "all new to us," Swanson explained.

If the wind generator remains cost effective and reliable, Swanson said he may purchase similar units for his other stations: KTFJ (AM) in Dakota City, Neb., and KTFG-FM in Sioux Rapids, Iowa.

Unistar Joins With Infinity

NEW YORK Based on a recently signed agreement, Infinity Broadcasting Corp. has taken over Unistar Communications Group's day-to-day business activities.

The agreement also stipulates that Infinity has the right to acquire equity interest in Unistar. Mel Karmazin, president and CEO of Infinity, also assumed the CEO position at Unistar. Unistar's Bill Hogan was named president of the company.

According to Unistar, "Infinity is expected to enhance the programming lineup of Unistar and improve its position in the radio network business."

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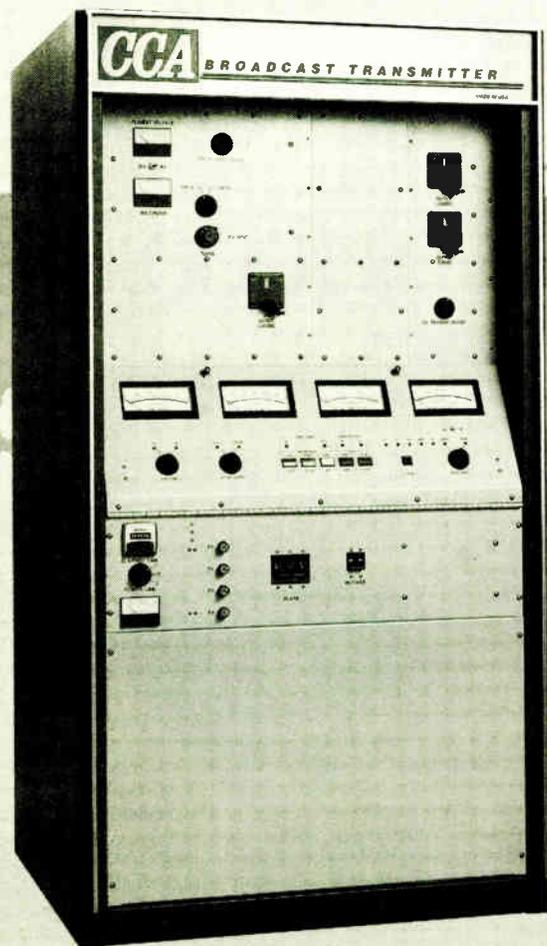
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DAR Compromise Sought

by John Gatski

WASHINGTON The Electronic Industries Association (EIA) seems willing to compromise on allowing digital audio broadcasting (DAB) delivery systems testing to be conducted outside its Digital Audio Radio Subcommittee.

The compromise may be forced by broadcasters' desire to have the National Radio Systems Committee (NRSC) test in-band systems. The NAB's Radio Board recently met in Naples, Fla.: as recommended by its DAB task force, the board adopted a resolution supporting NRSC testing of in-band testing.

Because the NRSC is comprised of NAB and EIA members, consensus would have to be reached in order for the in-band

embarked on a major effort to develop the U.S. digital broadcasting standard. The EIA planned to begin testing by April 1993 and to select a standard by the end of the year.

After initial meetings, the NAB had doubts about the EIA process, claiming it would be driven by manufacturers, not broadcasters. The NAB also maintained that broadcasters were not adequately represented in the proposed voting scheme.

The NAB proposed that NRSC test digital broadcasting systems, but also emphasized that it was not interested in any systems other than in-band.

The EIA countered that it had developed numerous standards, including TV stereo, and that testing would be objective, not focused on just one technology. Despite the controversy, EIA said it would adhere to its schedule.

In December, however, the most-talked about system, USA Digital's Project Acorn in-band, on-channel system, withdrew from the testing schedule. A USA Digital spokesman said it withdrew because of broadcaster concerns about the process.

At press time, quick resolution of the DAB systems testing question was in doubt. If the NAB succeeds in getting in-band tested through the NRSC and the EIA pursues testing of out-of-band systems, there may not be a unified standard, although it is unlikely that receiver manufacturers would create products that are incompatible with what broadcasters are transmitting.

The NAB's Rau acknowledged the danger of the two groups going separate ways. "The more controversy that is created, the harder it will be to bring DAB to reality," Rau said.

The DAB testing conflict erupted in mid 1992.

testing to be conducted by the NRSC. The issue was discussed at the Jan. 8 NRSC meeting at the Winter Consumer Electronics Show (WCES) in Las Vegas and at a Jan. 27 Digital Audio Radio Subcommittee meeting in Monterey, Calif.

Gary Shapiro, vice president of the EIA's Consumer Electronics Group, confirmed that EIA is trying to stem the division between NAB and EIA over the digital broadcast testing issue. "We are exploring alternatives," Shapiro said. "I think it is important to have consensus."

According to Michael Rau, NAB's senior VP for science and technology, the NRSC should conduct the tests for in-band because it is the only system broadcasters are considering for DAB.

"We are hoping that the EIA will agree," Rau said.

The DAB testing conflict erupted in mid 1992, shortly after the EIA

Technical Terms Traced To Scientists of Yore

by George Riggins

LONG BEACH, Calif. We use many terms in our everyday work to denote the parameters of equipment operation. We take for granted such units of measurement as gauss, weber, henry, ohm, ampere, faraday (the farad), hertz and many more without ever knowing why or how such terms came into being or use. And in some cases the definition goes back so far in the history of Mathematics and Physics that few, if any of us, really stop to investigate the term.

I conducted some research at the local branch of the Long Beach Public Library and discovered a paucity of information

the many other interests of Gauss such as Astronomy, Geodesy, Mathematical Physics or Analysis Situs. Gauss contributed knowledge and theory to all of the various facets of Mathematics in which he participated.

A brief biography of Gauss indicates that he exhibited his first bit of vast insight into the field of math when only ten years old. In his first regular math class, the instructor recited a long list of numbers to be added. As each pupil finished his work he was supposed to put

continued on page 10 ▶



on the majority of the early pioneers. I found two books among the holdings in the library: "The Britannica Encyclopedia" had a blurb on all but Righi and Maxwell, and "The Britannica Dictionary of Scientific Biography" contained slightly more than two columns on Righi and over 32 pages on Maxwell.

Of the two books, one was on the shelf at the branch in paperback, and the other had to be ordered from the main holdings. The paperback, "Men of Mathematics" by E. T. Bell (1883-1960) was published in 1937. Dr. Bell was, at the time of writing, Professor of Mathematics at California Institute of Technology, Pasadena, California.

In his book, Bell devoted one chapter to Johann Friederich Carl Gauss (1777-1855). Nowhere in the chapter is there more than a passing comment to any of

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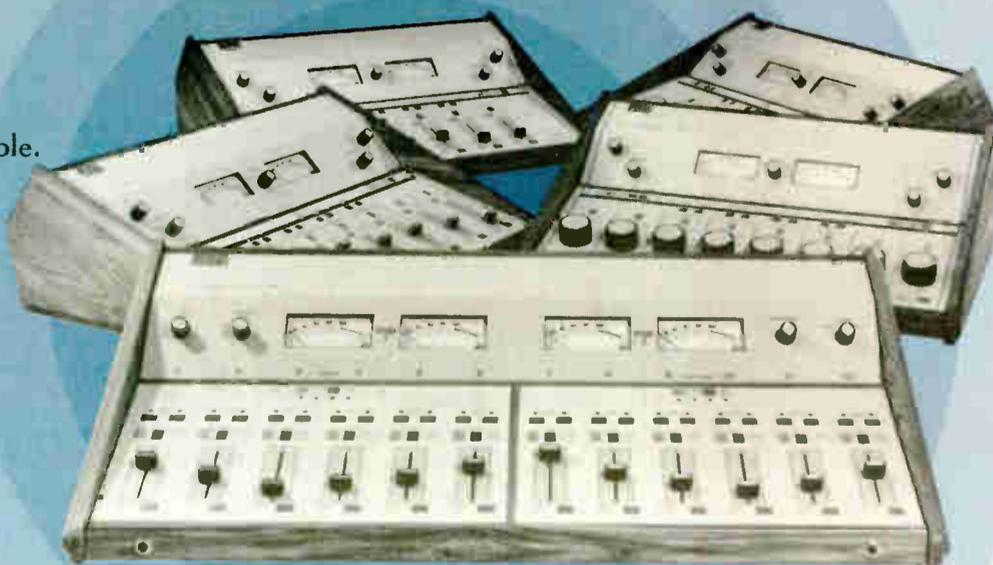
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Terms Traced to Scientists of Yore

► continued from page 9

his slate on the teacher's desk, the slates then being in reverse order as to the completion sequence.

It is said that the instructor had barely finished stating the problem in arithmetical progression—i.e. $81297 + 81495 + 81693 + \dots + 100899$ for a total of 100 numbers—when Gauss placed his slate on the table with the statement *Ligget sé*, (there it lies). When the other students had finished, the instructor found only one number on the slate of Gauss, the correct answer.

The instructor, a man named Buttner, was so impressed with the spontaneous display

of knowledge that he purchased the best text book on arithmetic obtainable at the time and gave it to Gauss. The instructor is quoted as saying, "he is beyond me, I can teach him nothing more."

Fortunately for Gauss, Buttner had a young assistant of seventeen years named Johann Martin Bartels (1769-1836) who bonded with Gauss and maintained a friendship that lasted the rest of Bartel's life. The duties of the assistant included helping the beginners in writing and the sharpening of their quill pens.

One of the many items of help provided

by Bartels was bringing Gauss to the attention of several men of influence. It was one of these men, Carl Wilhelm Ferdinand, Duke of Brunswick, Germany who became interested enough in Gauss to receive Gauss, for the first time, in 1791. Gauss was at the time only fourteen. The Duke assured Gauss that his education would be continued.

The following year Gauss entered Collegium Carolinum in Brunswick. The Duke paid the bills, and continued to pay until Gauss finished his formal education. In addition, the Duke paid for two years of Language and Classics study at the Gymnasium.

According to Dr. Bell, Gauss helped make Mathematics a science distinct from Mathematical Astronomy and Mathematical Physics. It is actually the contributions to the latter for which we in electronics are basically concerned.

Gauss completed his formal education with the granting of a doctorate in 1799—in absentia—from the University in Helmstedt. His dissertation was a proof of the fundamental theorem of Algebra which states that every equation with complex coefficients has complex solutions. This theorem had been only partially proven before.

He published his first paper at age 24. The title was *Disquisitiones Arithmeticae*, which formulated the systematic and influential concepts and methods of number theory.

Two contributions to Astronomy concern the calculation of orbits of asteroids. The first orbit calculation concerned the asteroid Ceres. Astronomers were able to observe the asteroid for 40 days in early 1801 as it approached the sun before being lost from view. Gauss, with only three observations, calculated the orbit of Ceres so that at the end of 1801 and in early 1802 astronomers were again able to find and track the asteroid Ceres.

Gauss used his method of Least Squares to do the calculations. Using the same methods Gauss predicted the orbit of the asteroid Pallas enabling astronomers to also find and track that asteroid a few years later. The methods were published in *Theoria Motus Corporum Coelestium* in 1809. The same methods with minor modifications for the modern computers are still in use.

We can divide the interests of Gauss into four distinct periods. The first period, from about 1800 to 1820, concerned astronomy of which comments have been made. The second interest period for Gauss was taken up with Geodesy, theories of surfaces and conformal mapping.

From this second period of interest and investigations came differential geometry—the study of curves and surfaces in the immediate neighborhood of a point. From this we now have conformal mapping. As Dr. Bell explains conformal mapping, it is in constant use in mathematical physics and its applications in electrostatic, hydrodynamics and the off-spring, aerodynamics—the airfoil.

The third period of investigation by Gauss was from approximately 1830 to 1840. He concerned himself with the study of Mathematical Physics, particularly magnetism, and the theory of attraction according to the Newtonian Law. It is this period that brings modern electronics most into contact with the work of Dr. Gauss. It was during this time period that Gauss and Weber did most of their collaborating.

The fourth period of applied study for Gauss was from about 1841 to 1855. He was concerned with analysis situs and geometry associated with functions of complex variables.

□ □ □

George Riggins has experience in radio and electronics dating back to the 1930s. He also is a licensed ham radio operator and has had his own broadcast sales and service company, Riggins Electronic Sales, for more than 20 years. He can be reached at 310-598-7007.

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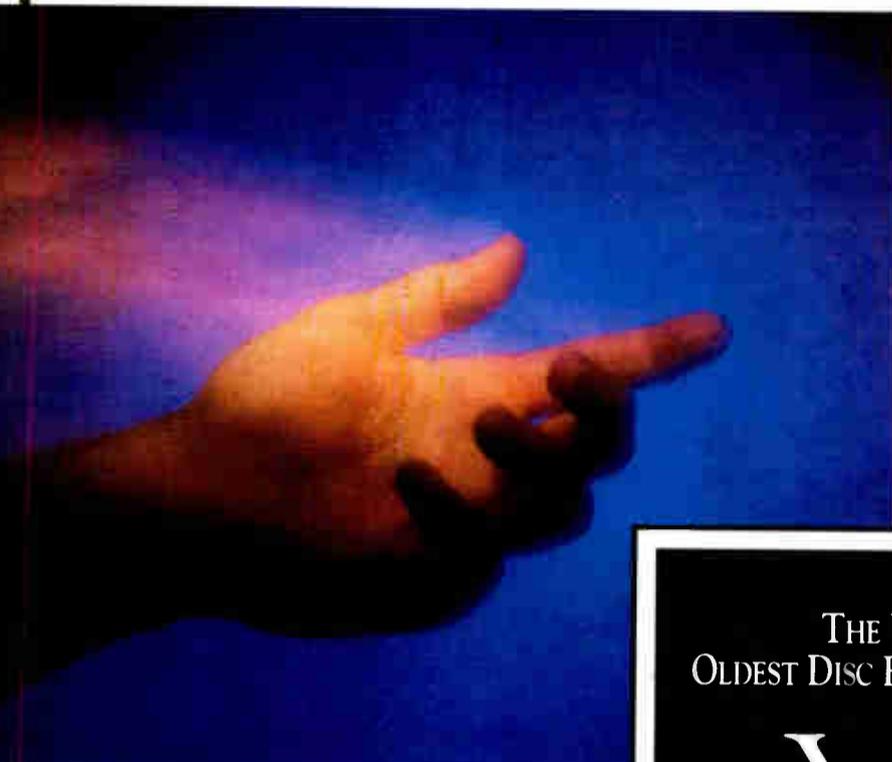
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Call Pioneer and ask about the CAC-V3200 Compact Disc Autochanger. You'll find it to be a simple decision that deserves a big hand.

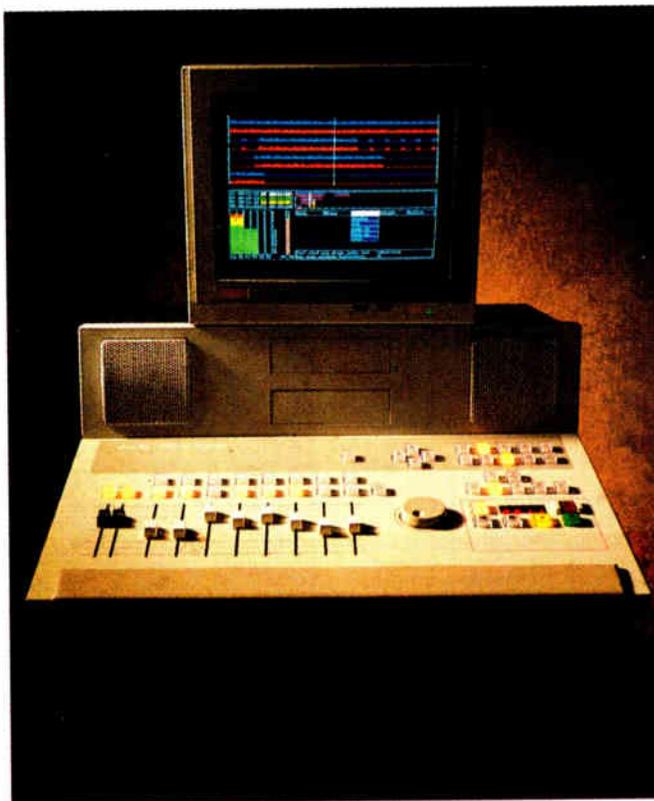


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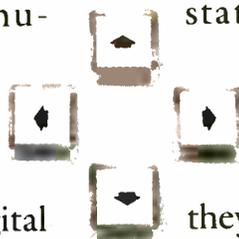
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Studio Sessions

Miking: The
Big Picture,
p. 16

Equipment and Applications for Radio Production and Recording

NAMM Mixes Pro Audio and Music

by Mike Rivers

ANAHEIM, Calif. The National Association of Music Merchants (NAMM) Winter Market, held annually at the convention center in Anaheim, Calif., is one of the music and audio industry's largest toy shows.

Although geared primarily toward the musical instrument (MI) market, nowadays there's substantial crossover into

a shoe box, provides analog and digital inputs and outputs, some digital signal processing, and a SCSI bus interface. The CBX-D5 connects to a computer as a SCSI peripheral, and uses any disk drive on the SCSI bus as the audio recording medium.

The power of the CBX-D5 is that, since it's a SCSI device, it's completely computer-independent, and surprisingly software-independent, too. They were

non-destructive editing capability, level and balance adjustment, fades, EQ, and the ability to mix sounds from multiple sources—for instance, music, narration, and sound effects. Don't try to run one of these on the "office" computer, though. They eat up a lot of disk space.

Production recording gear

The new Soundcraft Spirit Folio is the neatest small mixer I've run across since the Mackie 1202. Its clever portable configuration features a carrying handle that serves as a rear prop to get the working surface tilted to a comfortable angle. It's probably most applicable to small remote recording work, but is also available in a rack-mount configuration.

The Folio features two pairs of stereo line level inputs and either six or eight mic/line inputs, depending on the size you buy. Mic inputs have three-band

EQ with sweepable midrange and a switchable low-cut filter; the stereo line input EQs have two bands. PFL solo and two Aux sends are provided on all channels. There are no channel insert points, but there's an overall Left and Right insert, so you can protect your mix with a stereo compressor. The mic inputs provide phantom power, and the stereo tape return can be routed either to the mix for an extra pair of stereo inputs, or to the monitor section for listening to playback. Separate monitor outputs as well as a headphone jack are provided so you can do your monitoring on speakers. Good design, good specs, and it's a Soundcraft.

Panasonic has recycled its SV-DA10 DAT deck that was in the consumer marketplace for a short time a year and a half ago. Now, with a new paint job to match the pro line, the deck is being sold as the SV-3200. It's been modified to allow selectable 48 kHz or 44.1 kHz sampling

continued on page 15 ▶



Musical instruments (and musicians) compete with pro audio gear for the attention of visitors to the NAMM Winter Market each year.

the pro audio field, with many MI dealers also serving the pro audio market. This is a fast-moving industry and there were plenty of new products and updates in the short period of time between October's AES and January's NAMM. So, with an eye on new products introduced at NAMM that could be handy to have around the broadcast or production studio, here's a tour of some of the highlights of the show.

Workstations everywhere

Computer-based digital audio workstations were everywhere, with most systems offering a Windows (IBM) version. Digidesign and Yamaha both introduced new systems, fairly heavily hardware-based, with the approach that the computer is used as the display and controller, and all the dirty work is done in their dedicated boxes. This has the advantage of allowing you to use your favorite computer platform independent of the digital processing hardware. Digidesign's Session 8 system provides the equivalent of a complete eight-track digital studio with moving faders on screen for mixing, and a hardware controller for hands-on control. Macintosh software is pretty well along, but the Windows version is still "almost ready."

Yamaha's new CBX-D5 hard disk recording system takes a slightly different approach. This unit, about the size of

demonstrating it on an IBM and Atari ST running versions of Steinberg/Jones' Cubase Audio for those platforms, and on a Mac with Mark Of The Unicorn's Digital Performer. On-board digital equalization and reverb/modulation effects are taken from the popular studio multiple effects unit, the SPX-900.

... nowadays there's substantial crossover into the pro audio field . . .

Hardware and software supporting the workstation-in-a-computer approach from Innovative Quality Software (SAW) and Turtle Beach (56K/Soundstage) have both seen software upgrades since AES, and have set the price for getting into a production-capable system right around the \$4,000 mark. This will buy you a digital audio processing card, software, a Windows-capable computer, large high resolution computer monitor (essential to preserve your eyesight and patience), and large capacity hard disk drive, using a DAT as the audio I/O interface.

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World Radio History

NAMM Show Mixes Pro Audio and Music

► continued from page 13

rates on record from the analog inputs, but it does obey the SCMS encoding and decoding rules. Analog I/O is -10 dBu level on RCA jacks, with digital I/O on optical and IEC-958 (S/PDIF) RCAs. Not a bad deal for a "second" DAT, or for mixdown if you can deal with the copy protection.

And doggone if the people at Sony didn't go and do the same thing with the soon-to-be-discontinued model DTC-670. They put a new label on it, added rack mount brackets, and resurrected it as the DTC-A7 DAT recorder for musicians and home studio artists. Inputs and outputs are the same as the Panasonic SV-3200, as are the sampling rates, SCMS functions, and (at this point approximate) retail price of just under \$1,000. This seems to be a pretty clear message that manufacturers still want to market a semi-pro product to satisfy the people who would probably have been the largest group of purchasers of consumer model DATs.

The Alesis ADAT eight-channel digital recorder is starting to show up in production rooms. JLC Cooper showed a new synchronizer for the ADAT that allows it to be locked to SMPTE or MIDI Time Code without using a track. It allows the ADAT to be either the slave or the master in a time code lockup situation, and it also offers an optional Sony nine-pin video controller connector so it can be controlled by a video editor.

Denon's new DN-1200F is a 200-CD changer well suited for automation systems. The selling point with this unit is its compact size, storing 200 CDs in less space than they occupy in their jewel boxes. Maximum access time from any track on one disc to any track on any other disc is 15 seconds, with average access time being on the order of five seconds. Serial control via computer is standard, and a dedicated controller is promised in the near future. Denon is currently working with Gefen Systems

to adapt that company's current CD control and database software to the DN-1200F.

Processing developments

You can never have enough signal processors, so hot on the tail of Sony's recently introduced RS series, Roland introduced two new single rack space

This is a fast moving industry and there were plenty of new products and upgrades introduced on the January NAMM exhibit floor.

digital processors, the SRV-330 Dimensional Space Reverb and the SDE-330 Dimensional Space Delay, priced competitively with the Sony RS.

These units use some of the technology for spatial location that Roland developed for its very cool but very expensive "pan the sound to any point in three dimensional space" processor. This effect is pretty subtle on the SRV-330, since what you're panning in space is the early reflections. The real reverb pretty much fills up the whole space (as it's supposed to). You can give the illusion of a reflection off a side or rear wall, but you have to have someone tell you what's happening before you figure out what you're hearing. It's mainly another very good sounding reverb with a slight twist (that you don't have to use).

The SDE-330 delay is much cooler (and much easier to over-use, too). It's a multi-tap delay, and two of the delay parameters are azimuth and elevation. One of the presets will make a drum set pan around you in a circle, without any hidden rear speakers or decoding—you can put it in the mix, and people will hear it that way! You can also use it to place a sound behind or above the listen-

er—very impressive, but you won't use this effect every day.

If you have a Lexicon 300, there's a software upgrade for it. Version 3 offers several new split configurations, new reverb algorithms, and source balance for both analog and digital inputs. In addition, more extensive time code automation has been added, allowing

cal instruments, so here's some news on a couple that might just find their way into the production room. Akai has a new line of samplers, the S2800/3000/3200, which extend the popular 1100 series. The 3200 can be used as a hard disk recorder as well as a musical sampler, providing a one-box solution to many routine production tasks.

New workstations

The models are built around the same basic engine and differ primarily in memory capacity, expandability, effects processing, and I/O configuration. Roland introduced two new keyboard workstations, the JV-1000 music production workstation, and the DJ-70 sampling workstation. The JV-1000 is essentially a combination of a JV-80 synthesizer and MC-50 sequencer, built on a 76-key keyboard. An add-on expansion board provides full general MIDI capability and an additional 28 voices. The DJ-70 is an incredibly easy-to-use sampling keyboard which is ideal for playing sound effects and background music loops in the on-air studio at the press of a key.

I love to search the corners for those non-mainstream products, and I found one from In-Perfect Sound: a motorized mic boom perfect for remotely adjusting a mic position on a person, instrument, or amplifier in another studio. Wonderful idea! I wish I had more space to tell you about the self-tuning guitar or the MIDI controlled violin. Things like that make NAMM the blast that it is.

□ □ □

Mike Rivers operates the Washington MIDI Users Group BBS (703-532-7860) and can be reached on line through the MIDILink Network.

setup changes to be automated via MIDI time code.

MusicBytes from Prosonus is a CD ROM containing 27 original musical compositions in a variety of styles, very professionally played, plus over 100 sound effects. The music is license-free (with some fine print) and includes a librarian program for Mac or Windows which allows you to search, audition, and copy data from the CD ROM to your disk for incorporating into a presentation. This isn't a "listen for entertainment" product; rather, it's one that you'd use to add music to a multimedia presentation or commercial spot. The music is pre-edited in 5-, 15-, 30-, and 60-second lengths and is duplicated in six different formats: CD audio, MIDI file (General MIDI setup), 22 kHz or 11 kHz WAV files for PC, and 22 kHz and 11 kHz AIFF files for Mac. Sound effects are in both 11 and 22 kHz formats.

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LINE OUT

What's Wrong with This Mic Picture?

by Bruce Bartlett
with Jenny Bartlett

ELKHART, Ind. Here's a little quiz to check your understanding of stereo mic techniques. The figures show a bird's-eye view of several miking methods, all using cardioid mics. Those in the left columns are wrong; they result in poor stereo imaging or bad balance. Those in the right columns are correct; they tend to give accurate, sharp imaging.

You might want to guess what the problems are with each lettered technique. The answers are below.

First, a disclaimer. These "rights" and "wrongs" are not absolute. There might be situations where doing it "wrong" works best, or is your only option due to visual constraints.

A) Technique "A" is a coincident pair of cardioid mics angled 0 to 90 degrees apart. The mics are not angled apart enough to give a wide stereo spread. You'll hear a narrow stage width unless the musical ensemble surrounds the mics in a semi-circle. If you substitute a pair of bidirectional or hypercardioid mics, however, an angle of 90 degrees can work great.

Sometimes you want a stage width that does not extend from speaker to speaker—say, for a string quartet or a piano/vocal recital. In this case, 90-degree angled cardioids can work well.

But the room reverb will not sound very spacious.

B) Here, the mics are angled too far apart. You'll hear a hole in the middle. Plus, instruments in the center of the ensemble are picked up 90 degrees off axis to each mic, so they will tend to sound dull or tonally colored.

C) The diaphragms of the mics are not vertically aligned. The slight horizontal spacing between mics will cause the highs to roll off in mono. That is, there will be phase cancellations at high frequencies when both channels are combined to mono.

There might be situations where doing it "wrong" works best . . .

D) In this method, the mics are spaced apart and angled inward. The left-spaced mic is aiming right; the right-spaced mic is aiming left. This creates conflicting time and amplitude cues. You'll hear vague, inaccurate imaging.

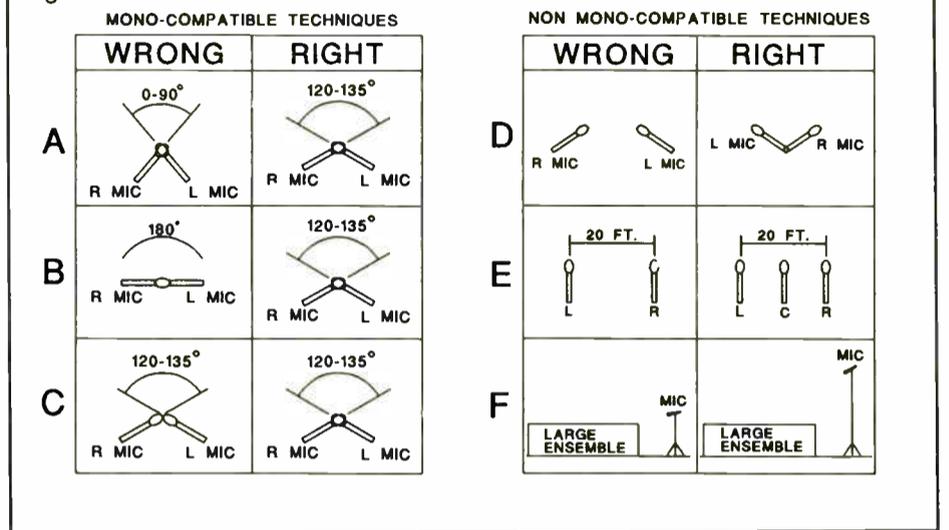
E) The spaced mics are so far apart, you'll hear exaggerated separation. That is, instruments slightly off-center will be reproduced from the left or right loudspeaker. Adding a third mic in the center tends to restore accurate imaging.

I hesitate to call the left pair in E "wrong" because it has a lot going for it. For one thing, it's less conspicuous. Sometimes this is the most important

mic is not raised enough to get a good front-to-back balance of the musical ensemble.

The next time you do a stereo remote, listen to what the mic placement is doing to the stereo imaging and to the musical balance. Can you localize each instrument clearly? Is the reproduced stage too wide or too narrow? Does the ensemble

Figure 1.



consideration. Also, the spaced pair can work well on a wide sound source, such as a pit orchestra for a musical. And since there's no center mic, you don't need a mixer. You can run the two mics directly into your recorder or mic preamps.

F) Here, the mic is much closer to the front-row musicians than to the back-row musicians. So the front row will sound too loud relative to the back row. The

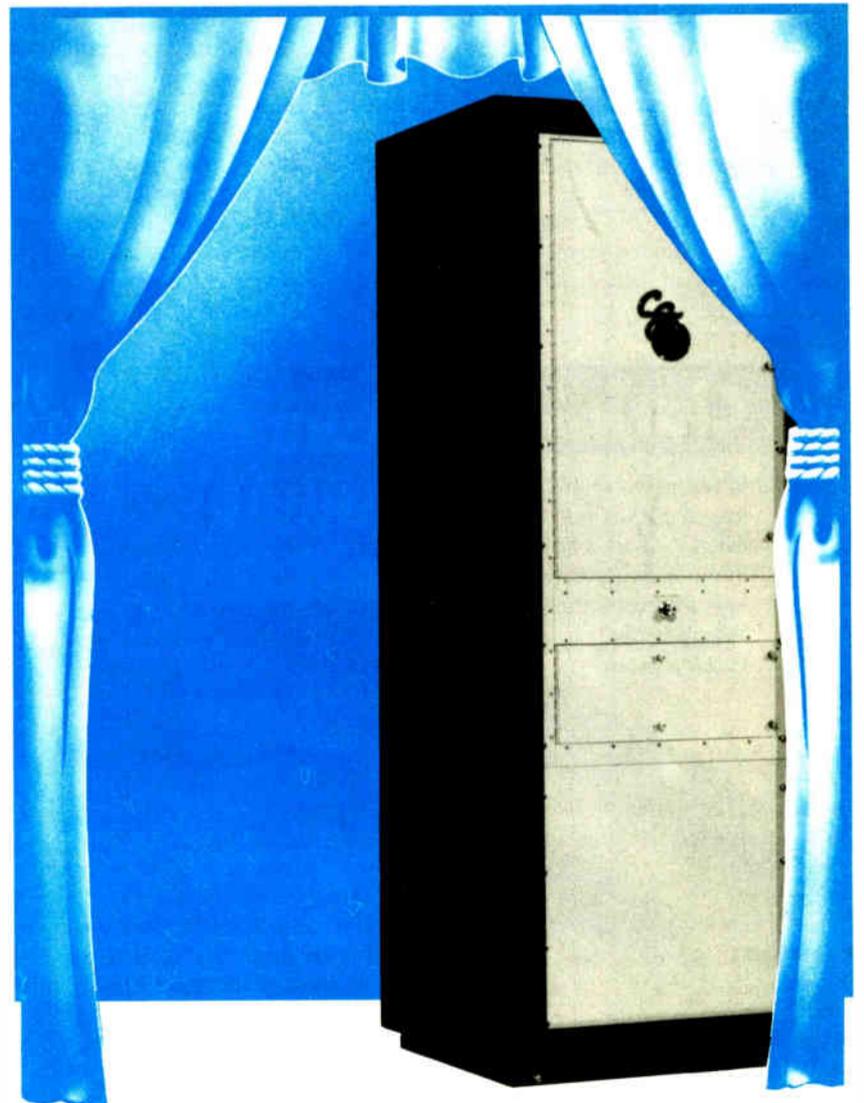
have a natural balance? The answers will help you refine your techniques.

□ □ □

Bruce Bartlett is a microphone engineer and technical writer for Crown International, and the author of *Stereo Microphone Techniques* published by Focal Press. Jenny Bartlett is a technical writer. Bruce can be reached at 219-294-8388.

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PRODUCER'S FILE

The Korg SoundLink: Taking a Test Drive

by Ty Ford

BALTIMORE In the last installment of *Producer's File*, I began a review of the SoundLink, Korg's \$37,000 entry into the workstation market. In that article I covered the basic input, output and hardware information.

The conclusion of that article addressed a problem one of the early software releases had in the smallest increments of sound the SoundLink could deal with. Several years ago, the SoundLink could not deal with any audio segments less than one second long. According to Korg's Michael Haprov, it was one of those house-keeping things. With every segment at least one second long, SoundLink had no problems with handling simultaneous cross-fades on all eight channels.



The Korg SoundLink, set up and ready for action in Baltimore's Producer's Video.

This is one of those problems that all hard-disk systems can have. If you've got eight cross-fades happening simultaneously, you've actually got 16 different source points, two per track. If the system doesn't have enough read heads, or the read heads don't move fast enough, there's no way to get the sound off the disk. Fortunately, software update 3.0g seems to have solved the problem. With the minimum recording time factor problem solved, there's a lot to be said for the SoundLink.

If you've seen any of the Korg literature, you've probably seen Bob Bragg's picture and read his comments about the SoundLink. I've known Bob for some time. He's a straight-arrow guy who's not prone to hyperbole. I found it significant that, after months of research, he ordered a SoundLink. I had to know why.

Four reasons

Bob does all of the major audio at Producer's Video, a post house here in Baltimore. Most of the company's work consists of commercial and corporate video production, using 1-inch, D-2, betacam and 3/4-inch video machines. According to him, SoundLink's internal synchronizer has worked well with all of the video machines.

Bragg's top four reasons for getting a SoundLink were: price, the fact that it

has a dedicated console, the fact that the software never crashed or locked up and that it did what Korg said it would. In addition to the initial six-hour demo, he also got two days of on-site training as part of the deal.

The two Korg field reps are available by beeper 24 hours a day. The company is also committed to evolving the software based on suggestions from clients. Of course, this is made somewhat easy by the fact that, at this time, there are fewer than a dozen systems at work here in the U.S. During my six-week evaluation period I received two upgrades.

From the looks of it, Korg has been working so hard on the software, they haven't had time to update the documentation. After things settle down a bit, I'm hopeful they'll be able to get around to it. Version 3.0g, the last version I

received, had 39 changes. I don't have the space to print all of them, but I'll list some of my favorites:

- The ability to handle sound segments as small as 10 milliseconds. If you really need to go below that, I'm sure Korg would like to hear about it.
- Searching by alphanumeric QWERTY keyboard entry is supported for all sound directories.
- A remote offset function exists, to facilitate locking to a VTR without a time code reader.
- You can choose to "squeeze" or optimize the hard drive after each recording.
- If you run out of fader/mute automation, you can reassign some of the MIDI memory to the automation system.
- You can backup or restore any number of sessions, from one to all.
- The scrub buffer has been enhanced so that, if you pass out of the buffer range, the system automatically grabs the next section of audio and sticks it in the buffer after only a slight delay.
- Part of the noise gate circuitry has been configured to act as a record trigger. Any level over threshold automatically puts the system into record.
- Stereo pair editing is now supported.
- The frequency range of the mid-band graphic EQ has been widened to 50 Hz-12.0 kHz.

As you can tell, most of the changes are not due to bugs that had to be fixed. Instead, most of them are simple shifts in the system that make it easier to get around on the SoundLink.

Getting started

After a two-hour jump start phone session with Haprov, I threw myself against the learning curve just to test how steep it was. Because of the dedicated controls, navigating the console is relatively easy,

continued on page 20 ►

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Columbia Offers a Sound Education

by Bruce Ingram

CHICAGO Columbia College Chicago recently invested in a state-of-the-art production facility as part of the school's comprehensive curriculum in Sound Arts.

The college has acquired the Zenith/dB recording complex in a long-term lease arrangement. Columbia will use the complex, which contains two complete film mix suites, a video post production suite, a 24-track recording studio, two voice-over and production rooms and full transfer and dubbing facilities, to house its growing Sound Arts Department.

The Sound Arts major spun off from Columbia's Radio Department five years ago and drew together audio courses from the college's various electronic media programs. The department already made a significant investment last spring in a state-of-the-art digital audio production lab.

Program Director Doug Jones says Columbia will combine its digital production facility with Zenith/dB's more than \$1 million in analog equipment to create The Columbia College Audio Technology Center. With these new acquisitions and more than 700 students enrolled, Jones says Columbia now has one of the largest and best-equipped audio programs in the country.

Unique opportunity

In addition to providing an up-to-date, working production environment, Jones said the Center will also give Columbia's sound arts students a unique opportunity to perform maintenance on the equipment and to use it experimentally.

"We focus on the technology that makes the recording studios work," Jones said. "Our purpose is to train professional sound people in a variety of specialties."

"We are not a recording school. We don't crank out recording engineers who push buttons."

Howard Sandroff, an expert in computer-based music and sound systems as well as a composer of electronic music, was instrumental in designing Columbia's dig-

synthesis in Columbia's \$75,000 digital production lab. The lab is basically composed of three Macintosh IIci computers outfitted with Digidesign ProTools soft-



Howard Sandroff, radio/sound department artist in residence; Doug Jones, coordinator of the Columbia College Sound Program; and Don Gates, radio/sound instructor.

ital lab and the Sound Arts major. His current title at Columbia (after 12 years as a math and science professor) is Artist-in-Residence, an arrangement that leaves him time for other pursuits, such as directing the Computer Music Studio at the University of Chicago and consulting for Yamaha Corp.

He agreed with Jones that students who hope to become successful audio operators in today's market "have to get way beyond just pushing buttons."

"There's an ongoing conflict between teaching machines and teaching concepts, because the machines come and go," he said. "The people who wind up working in the industry tend to have broad backgrounds, not narrow ones."

Sandroff teaches MIDI (musical instrument digital interface) programming and

ware to function as recording/editing workstations.

Technique and theory

"Anyone who does sound in any medium has to deal with digital audio techniques and the theories behind it," Sandroff said. "Having operators and creative people who are fluent in the technology is becoming critical across the board."

Don Gates, who runs his own business doing digital editing and assembly work for musicians who want to release their music on CD, teaches hands-on recording techniques in the new digital lab.

"These are fairly sophisticated systems," Gates said. "You can actually produce real, broadcast- and CD-quality audio from those workstations."

Gates began his multi-faceted career in audio production many years ago as a recording engineer in a studio where the multitrack machine he worked on didn't even have a tape counter. "We just stuck little pieces of paper in the reels to mark where the tunes ended," he remembered.

But he recognizes that those days are long gone and believes it is now impossible to have a career in audio without computer literacy. "You can't walk into a studio today that doesn't have a computer performing some function. You have to be comfortable with that."

Jones, Sandroff and Gates agree that increasingly sophisticated audio technology provides students with more career options. All three of them for example, in keeping with Columbia College policy, are working professionals in different areas of audio.

"There are many things you can do in audio besides working as a recording engineer," Gates said. In his opinion, that profession becomes more difficult to enter every day because so many studios are closing with the advent of high-quality recording equipment that people can buy and install in their homes for as little as \$5,000.

Also, he says that people who are lucky enough to find work as recording engineers often find the field less glamorous

continued on page 20 ▶



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SoundLink's Road Test

► continued from page 17

although it took me a while to adjust to simple things. For example, on my DSE-7000, the transport "stop" button is second from the right. The second button from the right on the SoundLink transport is the "pause" button. If you hit most of the buttons while in "pause," nothing happens. Because the scrub wheel changes its function depending on whether the "locate" or "edit" buttons above the scrub wheel are selected, you need to grasp that most of its work is done in the "edit" mode. The "locate" mode is used to move the audio back and forth on the edit screen.

There are seven modes: "Misc," "Disk," "Audio," "Mixer," "Effects," "MIDI," and "Mark." Each has its own button. You enter a category mode by

Because of the dedicated controls, navigating the console is relatively easy . . .

hitting the appropriate button and then go through the pages of each mode to perform a specific function. Although there are a total of 37 pages, they are

arranged logically. Most of the recording and editing work only requires use of less than a half-dozen pages.

Although learning the pages is not that difficult, I recommended that Korg put out a one-sheet flow chart of pages to help the new user. I also suggested that they beef up the headphone output,

+1 peaks, drove my Panasonic SV-3900 DAT machine digital inputs to a -6.

Another benefit the SoundLink offers is that you can use all of the disk time on one track. Korg has also engineered the system so that disk switching, when it does occur, doesn't disrupt the audio.

System maintenance

Because the system keeps all tracks recorded on the hard drive, deleting a single production does not erase the audio segments. The benefit of this system is that you can save different versions of the same production. In order to delete sounds from the disk, you have to go to the right page and purposely delete each segment. When I asked Bragg about these house-keeping chores, he said he generally spends about an hour each week cleaning up the disk.

As I stated in the first part of this article, the SoundLink is truly a second-generation workstation. In the six weeks I operated the system, it did not crash. After five months of use, Bob Bragg's hasn't crashed either. In the increasingly crowded field of digital audio workstations, the SoundLink stands higher than most.

□ □ □

Ty Ford may be reached at his beta test site studio at 410-889-6201, via MCI Mail 347-6635 or America Online (Tford).

Columbia Offers Sound Education

► continued from page 18

than they imagined, requiring long hours for low pay.

Gates and Jones rattled off a long list of audio career options, many of them poised for growth in the coming years: acoustic and electrical analysis, contracting for design and installation of sound systems, multi-media design for large corporations and ad agencies, integrating audio with film and TV, live sound for musical performances and public address situations, pro audio sales and even tape duplication.

"We don't want students to spend so much time and money on college and wind up flipping burgers," Gates said.

□ □ □

Bruce Ingram is an occasional contributor to RW.



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DIGITAL DOMAIN

Getting in Sync with Digital Gear

by Mel Lambert

STUDIO CITY, Calif. As an increasing number of broadcasters are discovering, digital technology can both enhance and extend audio creativity in the production studio. Digital audio workstations and random-access editors allow outstanding quality to be achieved, while performing multiple sample-accurate editing and processing. But, as we have seen in previous columns, digital systems need to be set up carefully if they are to provide reliable, trouble-free operation.

Of paramount importance is the provision of a master synchronization reference. In a simple set up—a DAT machine recording the digital output from a PC-based editing system, for example—the slave device's internal digital clock circuitry can lock up to incoming bit stream. By monitoring the Sync Blocks of an AES/EBU- or consumer-format digital input, the DAT recorder's master clock can be slewed, within reason, to match the sampling rate of the incoming bit stream. (Alternatively, a dedicated word-clock input serves the same purpose.)

Just so long as the sampling rates are not too far off, and reasonably time-independent, the DAT will self-lock to the workstation/editor, and record the digital signal to tape. Things become a shade more complicated, however, when we add more components to our digital production studio—outboard signal processors, for example, or a second workstation that's networked via digital I/Os to a series of playback DAT machines.

The golden rule

In a nutshell, we need to follow one Golden Rule: for reliable sample-accurate synchronization, all digital audio devices should share a common clock source. In terms of sync resolution, the following table lists some of the types of reference signals we might encounter in a typical radio-production studio, with their frequency and jitter performance; the idea here, of course, is to select the most reliable source we can as master, and have each designated slave derive its master clock from the same reference (See Figure 1).

As will be readily appreciated, because of their enhanced jitter/accuracy specification, either a house-video reference or AES-11 Digital Audio Reference Signal (DARS) are the best sync sources.

We can also begin to see problems that might be caused by simply allowing the slave DAT machine, for example, to lock

to an incoming bitstream, rather than derive its sync reference from a designated Sync Reference Signal. Not only might there be a variable amount of jitter on the incoming signal, but the bitstream might become intermittent, in turn causing the slave machine to toggle between external and internal sync reference, with inevitable results.

And, even though the AES3-1992 Recommended Practice specifies a tight sample-rate accuracy, it is not uncommon for such interfaces to vary quite considerably in terms of signal integrity, mainly because of sloppy design practices.

I would point out that it has been suggested that the Audio Engineering Society might provide a useful role to our industry by licensing the design to accredited

rates are equal (within a very tight ppm tolerance), and that each bit of information begins coincidentally. Frequency synchronization ensures that bits arrive at the correct intervals, while phase synchronization ensures that each digital word matches at source and destination.

Frequency and synchronization

In this way, all manner of bitstreams can be combined within digital mixers or workstations, processed through digital equalizers, limiters, compressors and other outboard hardware, and then recorded to tape, hard-disk and optical media. Just so long as all components in a digital facility are fully frequency synchronous and locked to the output of a highly accurate master clock source, interconnecting the equipment should be an easy procedure.

A complicating factor comes into play when we need to lock our workstation or editing system to timecode. Even if the

Figure 1.

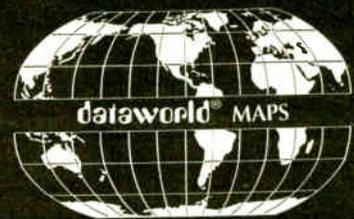
| Signal Format | Frequency Stability | Jitter Performance |
|--|---------------------|-------------------------|
| AES3-1992/IEC 958 Type I | 10-5 ppm | Very good |
| S/P DIF/CP-340/IEC 958 Type II | 10-3 to 10-5 ppm | Variable |
| AES-11 Digital Audio Reference Signal (DARS) | 10-5 or 10-6 ppm | Excellent |
| NTSC-format Video | 3 * 10-6 ppm | Excellent |
| PAL-format Video | 2 * 10-7 ppm | Excellent |
| Film sync reference | 10-3 ppm | Poor |
| SMPTE Timecode (LTC/VITC) | NA | Variable; normally poor |
| MIDI Timecode (MTC) | NA | Variable; normally poor |
| Analog tape recorder | Variable | Variable; normally poor |

equipment manufacturers. This is a function that the Society's loath to pursue, however, simply because it falls way outside its charter; the AES also lacks sufficient operating capital to evaluate every device on the market for full electrical and electronic compliance with its AES3 Recommended Practice.

Whatever synchronization source is chosen, it should be implemented carefully and consistently. In a nutshell, what we are attempting to achieve is frequency and phase synchronization; that our sampling

project does not involve lock to an external video transport—as would almost certainly be the case within a radio production studio—an increasing number of more advanced systems rely on internal timecode generators to tag events recorded to hard disk. In these circumstances the various data streams will need to be accurately time referenced. If correct frequency and phase lock is maintained, sample-accurate time lock for all audio events is entirely possible.

continued on page 38 ▶



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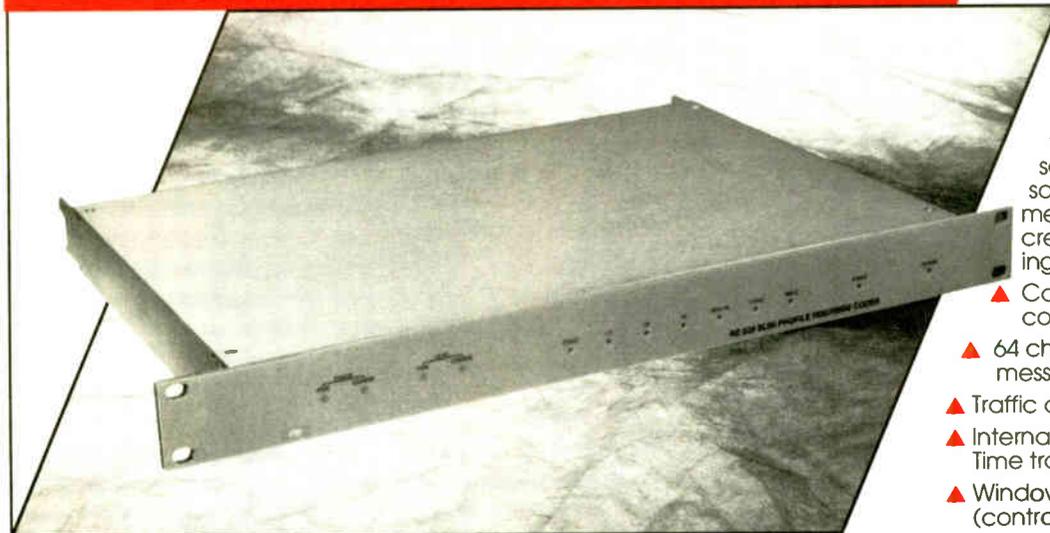
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Dimensions- 19" Rack mounted- 19"W x 5 1/4" (3RU)H x 16"D
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ECLECTIC ENGINEER

Successful Contests Avoid 'Gotchas'

by Barry Mishkind

TUCSON, Ariz. The big day has arrived. Your Rodeo Days contest has run its course and 100 semi-finalists have gathered to compete for the big prize, a new pickup truck. Exactly 100 keys are laid out for the semi-finalists to pick and see if they have the one that wins.

Only there's a minor problem, a small glitch.

It seems only 95 of the finalists have shown up, and horror of horrors, it becomes clear that the winning key has not been picked. Now what? Wait for the

lawyers to destroy what's left of a good promotion?

Expect the unforeseen

This actually happened to a major market station. Although they were able in this case to devise an acceptable solution that avoided the legal hordes, the lesson is clear: every contest has a hidden problem waiting to bite you.

Anticipating problems is necessary because so many things can go wrong. Have you considered what you'll do if the contest cartridge jams at a critical time? Running over to the shop and killing the

engineer won't solve the problem. But, having a standby cart might.

In fact, any contest depending on callers can go off the rails if you don't think ahead. Dangers lurk from bad phone systems as well as the professional players. What areas can the engineering staff watch to protect the contest?

Last time we considered how it's important to protect the security of the phone system. You don't want outsiders to know how many lines you have, nor where they're located. This will prevent "tappers" and slow down the demon-dialers.

While it might seem a large number of

incoming lines is best for selecting callers, one major market station found two (2) lines best for contests. They clear the first two callers, figuring the next two will be random. It seems to work for them.

Of course, sometimes even this can be beat. One fellow discovered a station was using a series of forwarded numbers from another county to hit two of the four lines in the studio. After conning the telephone company switchperson out of the real numbers, he was able to win contests almost at will by bypassing the call forwarding paths.

Other traditional devices for stopping the "contest pigs" have more or less success, as you begin to understand the weak points. For example, contests relying on pre-distributed number cards or flyers, or pre-registered personal information, can be overcome by players who keep a list of such information from all their friends and are ready to call for one other at any time.

Perhaps you send out a car and broadcast a license plate number from time to time. Between pagers and cell phones, these same folks with lists can generate a call from the "winner" very rapidly. And while bumpers promoting an upcoming contest can build nice AQH numbers, beware of running the contest at the same time every hour. Not only can you alert people to tune out for most of each hour, but consider how one Florida station ended up with a winner in New Jersey who simply called in at the "regular time."

Which is not to say that such contests are of no value. Perhaps having the contest is the end in itself, the winner being less important than the "on-air excitement."

Loopholes everywhere

Before ending this discussion, let's all resolve to join Loopholes Anonymous. Avoiding those crazy loopholes that seem to suddenly appear in the middle of a contest will do wonders for your gastric system.

For instance, one station thought it was protected by a rule forbidding employees "of the station or its sponsors" from being winners. Then they discovered their Grand Prize winner was, yep, you guessed it, from a competitor! They now exclude "employees of any station" from their contests.

Another station found that one DJ was unconsciously giving away the correct choices by the way he talked with the callers. Observant staffers gave him some quick lessons on having a better "poker voice" and prevented an abrupt end to the contest.

If you plan on using a "30-Day Rule," take steps to ensure you can accurately tell who has called, and when. Those stations in places where caller ID is operative can easily put the numbers into a database, perhaps available to the studio via computer terminal. Other possibilities include taping the voices of the callers, and comparing tapes of suspected frequent callers to stop them from using several names.

Indeed, as we've mentioned before, documentation is the biggest safety factor in successful contests. The more you have on paper and tape, the fewer problems and mistakes you'll turn up later. So document things each time the contest is run: When, by whom, which call number, name of contestant, result, etc.

□ □ □

Barry Mishkind, aka RW's "Eclectic Engineer," hides out in Tucson, AZ. He can be reached at 2033 S. Augusta Place (85710). Electronic addresses: BMISHKIND on MCI Mail, or "barry@coyote.datalog.com" on Internet (also via Compuserve).

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FEED LINE

Calculate RF Radiation Power Density

by W.C. Alexander

DALLAS It has been quite some time since we looked at the issue of RF power density and the FCC rules as they apply to this topic. With a whole batch of renewals coming up this year, a lot of engineers are going to be forced to take a long, hard look at their transmitter sites.

Whether any given site is in compliance will affect how Question 7 on the renewal application is answered. It might be wise to take a look right now, before the renewal application is on your desk.

The ANSI standard

ANSI's RF radiation guidelines are actually a set of recommendations drafted to prevent possible harmful effect in human beings exposed to electromagnetic and electric fields from 300 kHz to 100 GHz. These recommended limits are intended to be the upper limits of exposure. They are as follows:

ranges are 100 and 1 mW/cm², respectively. These figures are the yardsticks by which compliance with the guidelines and the FCC rules are measured.

In the text of its published guideline, ANSI says that the listed limits result in energy deposition averaged over the entire body mass for any six-minute period of about 144 joules per kilogram or less.

This six-minute time frame takes on some importance in the real world and in application of the guidelines. According to the ANSI guideline, the limits can be exceeded, if the average over any six minute period does not exceed the limit.

For example, let's say an engineer needs to read the base current at a 10 kW AM tower. Let's assume that the base current meter is located three meters from the tower base, and the RFR limit at this point is 3-1/2 times the ANSI limit. Our engineer can enter the high RFR

ple. In reality, he could remain a bit longer because he would not cross a line where the field changed from below the ANSI limit on one side to 3-1/2 times the limit on the other side; the field would build up on a curve as he approached the tower base. This is intended as a worst-case example. According to the ANSI guidelines, our engineer would be perfectly safe if he were in and out in 1:42.

FCC requirements

Section 1.1307(b) of the FCC rules addresses the issue of the exposure of workers or the public to excessive levels of radio frequency radiation. Specifically, this rule requires the preparation of an Environmental Assessment (EA) if a proposed new or modified facility authorized under parts 5, 25, 73, or 74 will cause exposure of persons to levels of RFR in excess of the limits. It's probably a safe bet that an application for a facility that doesn't make the grade with regard to RFR would not be granted.

Question 7 on FCC Form 303 (license renewal application) sets forth the same requirements as Section 1.1307(b). This question has resulted in a lot of grief for station owners and engineers. At license renewal time, each licensee must evaluate his antenna site and answer Question 7 on the form. Are the RFR levels at the tower site below limits? Good question.

The only absolute way to find out what

RFR power densities are near a tower base is by on-site measurement. Special instruments are available for rental and purchase from several sources for such measurements. Field strength meters will not work.

The good news is that measurement is not necessary in the majority of cases. The "FCC OET Bulletin No. 65, Evaluating Compliance With FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation," goes into great detail in explaining how to calculate RFR levels near FM and TV antennas.

Tables and charts are provided in the appendices of this bulletin (OET 65) that give worst-case examples as a quick check for compliance. These tables only apply to single radiators; if more than one station is operating from the site, the tables won't work. And remember, you are looking to make sure that RFR power density limits are not exceeded at any point on the ground, including the closest point on the ground to the antenna. The closest point is usually at the base of the tower, but that's not necessarily the case, particularly in extremely rough terrain.

Here's an example. WRFR operates from an antenna center of radiation of 100 meters above ground with a ten-bay antenna and 100 kW ERP H&V. Using the appropriate table in OET 65, we can quickly see that a station with 200 kW total (H+V) power and ten bays of antenna will exceed the ANSI limit at distances closer than 81.7 meters. Since the WRFR antenna center of radiation is 100 meters above ground, WRFR is A-OK.

These worst-case figures assume that the antenna functions as a single element

continued on page 28 ▶

Figure 1.

| Frequency Range (MHz) | Electric Field Strength (V ² /m ²) or E ² | Magnetic Field Strength (A ² /m ²) or H ² | Power Density (mW/cm ²) |
|-----------------------|---|---|-------------------------------------|
| 0.3 - 3 | 400,000 | 2.5 | 100 |
| 3 - 30 | 4,000 (900/f ²) | 0.025 (900/f ²) | 900/f ² |
| 30 - 300 | 4,000 | 0.025 | 1.0 |
| 300 - 1,500 | 4,000 (f/300) | 0.025 (f/300) | f/300 |
| 1,500 - 100,000 | 20,000 | 0.125 | 5.0 |

- f = frequency in MHz
- E² = electric field squared
- H² = magnetic field squared
- V²/m² = volts squared per meter squared
- A²/m² = amps squared per meter squared
- mW/cm² = milliwatts per centimeter squared

The limits of primary concern to radio broadcasters are those in the 0.3 to 30 MHz (AM) and 30 to 300 MHz (FM) ranges. Note that the power density limits for those

field and read the base current safely, if he is in and out in less than one minute 42 seconds (6 min./3.5).

This is, granted, an oversimplified exam-



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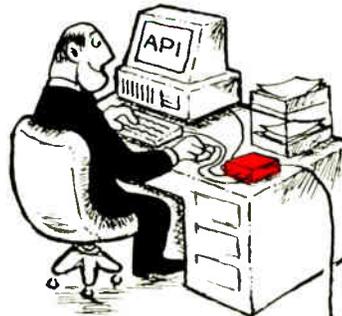
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Calculating Power Density

► continued from page 27

radiator with equal amounts of radiation at all angles including straight down (or towards the nearest point on the ground). Most stations use multi-element antennas which reduce the downward radiation when compared to a single element. Nonetheless, it is a good place to start.

FM formulas

The power density produced by an FM station at a given point can be calculated by using the following formula:

Figure 2.

$$S = \frac{(0.64)(1.64)ERP(1000mW/W)}{pR^2}$$

Where:

- S = power density
- 0.64 = ground reflection
- 1.64 = gain of a half-wave dipole relative to an isotropic radiator
- ERP = power (H+V) in watts
- R = distance from center of radiation in centimeters

The example the FCC gives is as follows: An FM station is transmitting with a horizontal ERP of 100 kW and using a circularly polarized antenna. The height to the center of radiation is 100 meters above ground. From the above formula, what would the calculated worst-case power density be at ground level 20 meters from the base of the tower?

First, find the slant distance from the center of radiation to the point on the ground. Simple trigonometry (is this an

oxymoron, or *what?*) yields a figure of 102 meters. Convert this to centimeters by multiplying by 100.

Next, work the numerator of the equation. Remember to add the horizontal and vertical power for the total ERP. Assuming the vertical ERP is the same as the horizontal, 200,000 watts is the total ERP.

The denominator of the equation is the good old pie-are-squared (Granny said they were round) that you no doubt remember from eighth grade geometry. R is the radius, or distance from the center of the antenna.

Your result should be 0.64 mW/cm² or thereabouts. Is this below the ANSI limit? The limit for the VHF region of the RF spectrum is 1.0 mw/cm², so the answer is yes.

If there are multiple antennas operating from the same tower, use this formula

Are the RFR levels of your station at the tower site below the limits?

for each and add the resulting power densities. Remember, the total power density is what we are interested in.

Some of you are thinking that this does not consider the vertical plane radiation characteristics of your super-duper whamo *saturator* antenna. That's right,

it doesn't; the results of these calculations give worst-case results.

To find the power density produced by a particular antenna at a given point on the ground, you will first need the manufacturer's vertical plane relative field graph. Find the angle from the center of radiation of the antenna to the point on the ground at which you want to determine the power density. Using that angle, find the relative field in that zenith for your particular antenna and use it in the following slightly modified equation:

Figure 3.

$$S = \frac{(0.64)(1.64)F^2ERP(1000mW/W)}{pR^2}$$

Where:

- S = power density in mW/cm²
- 0.64 = ground reflection coefficient
- 1.64 = gain of a half-wave dipole relative to an isotropic radiator
- F = relative field at zenith
- ERP = power (H+V) in watts
- R = distance from center of radiation in centimeters

This will give a much more realistic figure for power density. However, should the worst-case calculation show the RFR over the limit and you have to use the vertical plane radiation characteristics of the antenna to get a result that is within the limit, you should be ready to make a showing to the Commission on how you arrived at this result. The manufacturer's graph and tabulation of the relative field in the vertical plane will generally be required (as opposed to something you calculated or whipped up on your handy PC).

If there are multiple antennas on the same site, remember to calculate the power density produced by each station and add the results together to get the total.

Because many FM stations share their sites with TV stations (the TV guys say it's the other way around), we should take a look at the formula for calculating TV power density:

Figure 4.

$$S = \frac{(2.56)(1.64)(100)F^2[(0.4)(VERP)+AERP]}{4pD^2}$$

Where:

- S = power density in mW/cm²
- 2.56 = ground reflection coefficient
- 1.64 = gain of a half-wave dipole relative to an isotropic radiator
- 100 = conversion factor (to mW/cm²)
- F = relative field at zenith
- 0.4 = converts peak visual ERP to an RMS value
- VERP = total (H+V) peak visual ERP in watts
- AERP = total (H+V) aural ERP in watts
- D = distance from ground to center of radiation in meters

What about AM?

Because the power density limit for AM stations is so much higher than for facilities above 30 MHz, a person has got to get pretty close to the radiator to reach a point where the power density exceeds the limit. Trouble is, we get close to AM radiators all the time. After all, John Engineer has got to read those base currents.

The bad news, as far as this article is concerned, is that far field techniques won't work when calculating power density near the base of an AM radiator. For a quarter-wave tower, for instance, the E-field (electric field) near the base is relatively low while the H-field (magnetic field) is very high. The opposite is true of a half-wave tower. The scope of this article does not accommodate a discussion of the near-field prediction methods necessary to calculate AM power densities.

The good news is that OET 65 contains a table listing the distances at which fields from AM radiators are predicted to fall below the ANSI limit. See Figure 5 for an abbreviated list.

This makes prediction and evaluation pretty easy. Just look up the power level and find the corresponding distance. Anything farther away is okay; closer distances may exceed the limit. You can extrapolate from these values (or interpolate between the values in the OET 65 chart) for percentage of the limit; the constant seems to be 0.677. For example, for a 50 kW station at a distance of

continued on page 38 ►

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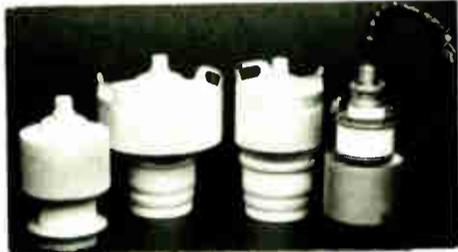
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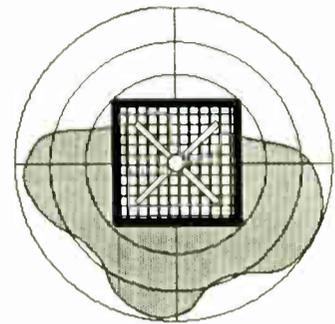
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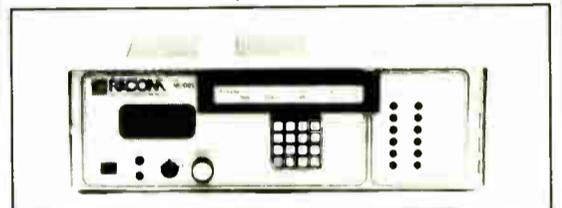
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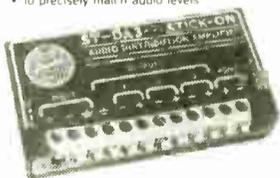
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Understanding the Role Of Capacitive Reactance

This is the seventh in a 10-part series called Fundamentals of AC. Northern Virginia Community College will offer 1.2 CEUs (Continuing Education Units) to registered students who successfully complete the course and an examination mailed at its conclusion.

To register, contact the Community Education Office, Annandale Campus, 8333 Little River Turnpike, Annandale, Va. 22003, or call 703-323-3168 or 323-3528. The fee for the course is \$30.

by Ed Montgomery

Part VII

ANNANDALE, Va. The properties of capacitance were previously discussed in this series of articles. Briefly; it is important to note that capacitors will not per-

more rapid the voltage changes, the greater the amount of current is induced. Thus as frequency increases, the capacitive reactance, measured in ohms decreases.

The formula for determining capacitive reactance is illustrated in Figure 1.

Consider a 50 microfarad capacitor operating at 60 Hz and at 1 kHz:

$$\text{At 60 Hz } X_C = \frac{1}{2\pi \times 60 \times 0.00005} = 53.08 \text{ ohms}$$

$$\text{At 1 kHz } X_C = \frac{1}{2\pi \times 1000 \times 0.00005} = 3.18 \text{ ohms}$$

Notice that at 1 kHz the capacitive reactance is about 1/16th its value at 60 Hz. As the frequency of the voltage change across the plates of a capacitor increases,

the opposition to current induction decreases.

As in an inductor, the voltage and current peaks in a capacitor are not in phase with each other. Figure 2 is an illustration of two sine waves. Waveform A indicates the voltage variations on the

Figure 1.

$$X_C = \frac{1}{2\pi f C}$$

f = frequency in cycles per second (hertz)
C = the capacitance of the capacitor in farads

mit direct current to pass through them.

However, when alternating current or pulsating direct current is applied to the device, the constantly varying charge on the plates will induce an electron current flow through it. This is a product of the changing intensity of the electro-static lines of force built up across the dielectric.

The rate-of-change of voltage varying the charge on the plates of the capacitor determines how much current actually will move through the capacitor. The rate-of-change can also be defined as the frequency of the signal applied to the plates of the capacitor. This is a measurement of cycles or pulses per second.

Capacitive reactance

As the frequency of the voltage on the plates of the capacitor increases, the amount of current induced across the plates correspond-

ingly increases. The relationship of voltage change to current produced is known as capacitive reactance. Capacitive reactance is expressed in ohms.

Figure 3.

Total capacitive reactance in series
 $X_{CT} = X_{C1} + X_{C2} + X_{C3} + \dots + X_{CN}$

Total capacitive reactance in parallel
 $\frac{1}{X_{CT}} = \frac{1}{X_{C1}} + \frac{1}{X_{C2}} + \frac{1}{X_{C3}} + \dots + \frac{1}{X_{CN}}$

ingly increases. The relationship of voltage change to current produced is known as capacitive reactance. Capacitive reactance is expressed in ohms.

At the direct current level where there is no current change, the charge on the plates remain constant and no current is induced. Under this condition, the capacitor will have infinite resistance. As the voltage changes, the electro-static lines of force vary and current is induced. The

rent by 90 degrees.

A form of resistance

Capacitive reactance is a form of resistance and one can determine the total reactance of capacitors in series, parallel, and series-parallel in a manner similar to finding total resistance in a purely resistive circuit. This is illustrated in Figure 3.

There are many instances where capaci-

continued on page 34 ▶

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WORKBENCH

Out with the Bad Air, In with the Good

by John Bisset

FALLS CHURCH, Va. Art Crane is a contract engineer in Arizona. He has determined that, as a rough rule of thumb, every dollar spent in generating waste heat in a transmitter will cost an additional two dollars to get rid of via an air conditioner.

With the general manager's blessing, Art

decided to vent the hot transmitter cooling air through the roof, rather than continue to allow it to exhaust into the air conditioned transmitter building. Art provided a small filtered opening to the outside of the building, to provide "make-up" air for the closed loop air conditioning system.

This made sense, since the 120-degree (F) make-up air on a typical summer desert day is still considerably cooler than

the heated exhaust air from the transmitter.

Several weeks went by with no problems. Then, Art began getting calls that the transmitter, a CSI T-I-F, was dumping. Several trips to the transmitter to fix the problem revealed nothing was wrong.

Finally, a pattern was recognized. The transmitter would run fine at night, when the desert air was usually dead calm. At sunrise (AM drive of course) the transmitter would dump.

As the sun warms the night air, it gets windy in the Arizona desert. Just the right gust of wind entering the building intake vent was enough to cause a flutter in air pressure. This caused the air switch to flutter, dropping the transmitter.

Art's cure for the problem was to add a "time delay before dropout" circuit to the transmitter air switch. Shown in Figure 1, when the proper volume of air flows through the chimney, the air switch closes. This charges C-1 through R-1 almost immediately. This turns on emitter follower Q-1 which energizes K-1. If the air switch opens and re-closes within two seconds, (the C-1 times R-3 time constant), the relay remains energized.

If the air switch opens due to a blower failure, the relay will drop in two seconds and shut down the transmitter. Art powered the circuit with a Radio Shack 12 volt power supply (Cat. No. 2731652).

The beauty of this circuit is that the usual failure modes of the delay circuit will still protect the transmitter. If any component fails in open circuit mode, the relay will drop. If C-1 shorts, the relay will drop. The possible exception is an emitter to collector short on Q-1.

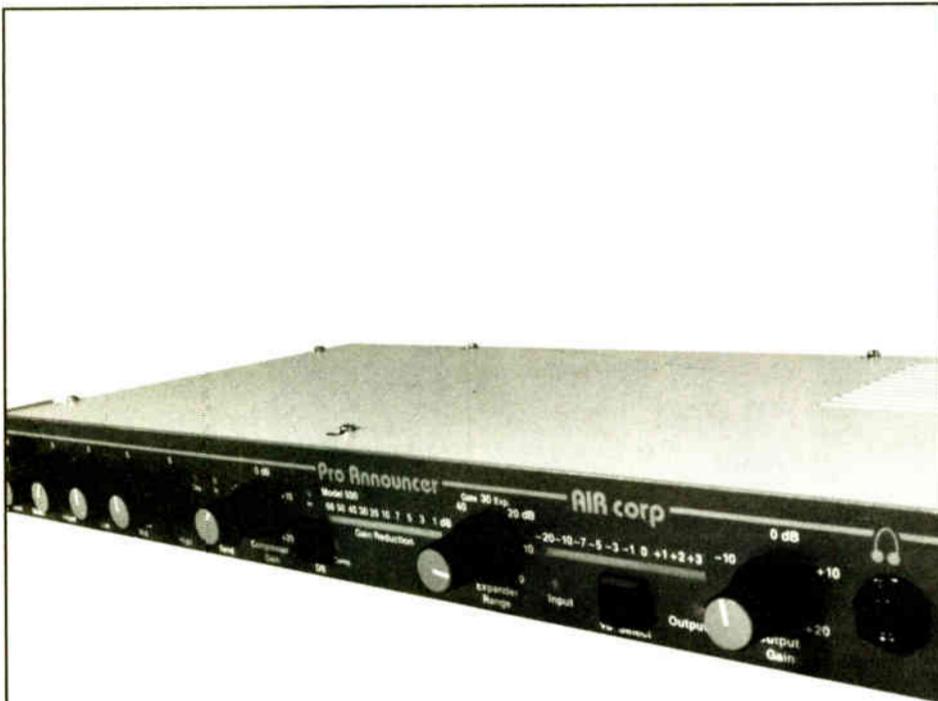
The second set of relay contacts could be

used to provide a status/alarm indication to the remote control. This feature can save you an extra trip to the transmitter. Art Crane can be reached at Desert R.F. Engineering, 602-453-3546.

★ ★ ★

We've featured some modifications for Technics CD players in the past, and here's a quick one for adding remote starts to the SLPG300 machine.

Using some wirewrap wire, solder two, foot-and-a-half pieces to a mini phone jack. Drill and mount the mini phone jack to the rear of the machine. Route the wires around to the front of the CD player. You will strip back about 1/16th of an



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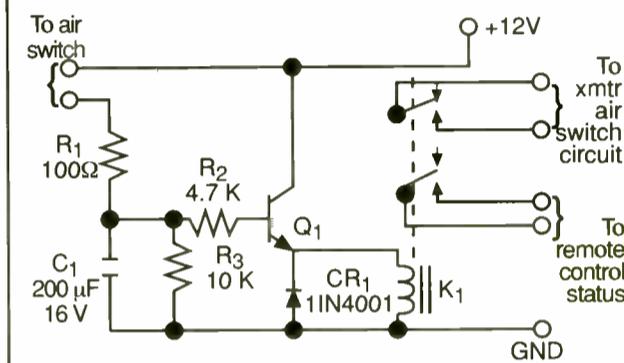
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Figure 1.



inch of the lead and tack solder it to the "START" or "PLAY" switch terminals located on the front panel PC board.

To reach these terminals (they are under the mother board), you must first remove the rear panel. Three screws hold the mother board. When they've been removed, pull the board back so it will separate from the four black multi-pin sockets that attach to the front panel. This procedure is much easier than trying to disassemble the front panel and leave the mother board intact!

At the bottom of the front panel PC board, directly opposite the "play" push-button are the solder contacts for the play switch. The contacts are identified by the common "# " symbol. You'll have to look closely, as this symbol on the PC

continued on page 38 ▶

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BOTTOMLINE BROADCASTER

Do-It-Yourself Amplifiers and Clocks

by Jim Wenstrom

JUNEAU, Alaska One of the advantages of being a small market engineer is the budget restraints under which we work. Well, it may not seem like an advantage, but it gets you to thinking when you need to get something done.

The secret to doing things with a restricted budget is to shop around when

you need parts. The secret to shopping around is to have a good supply of various catalogs.

One watt for one dollar

I recently received one from Hosfelt Electronics (1-800-524-6464). It is crammed full of useful parts and is a nice "wish-book." On the front page, a display caught my eye. A "1 watt dual audio

power amp" for 50 cents! It is a SGS Thomas TDA2822M eight-pin chip that will drive between 4 and 32 ohms, operate with a supply voltage of 1.8 to 15 volts. It even comes with spec and application sheets.

With the addition of 11 junk-box parts you have a nice handy amp.

So far I have used this circuit to replace a poor headphone amp in a production

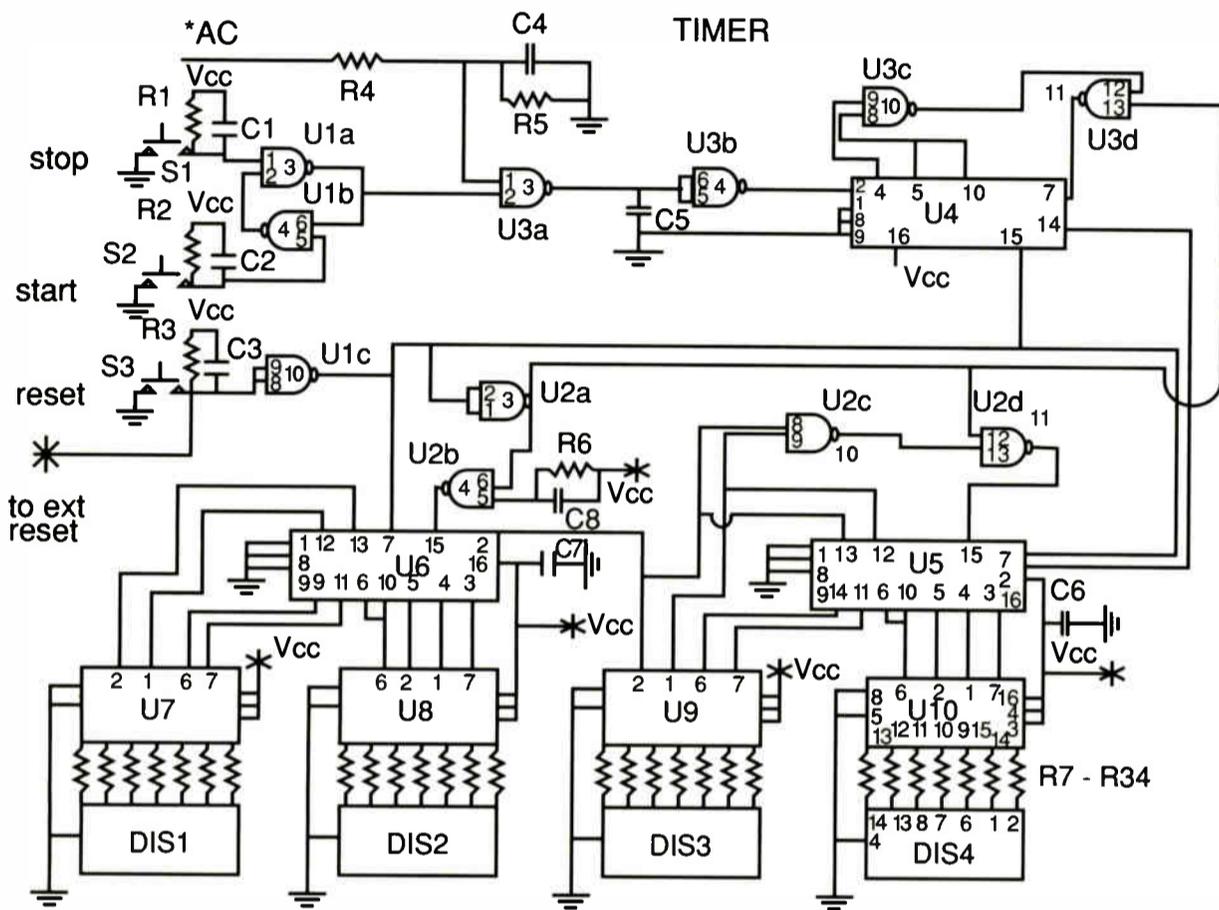
room. I used it to add an amp to my portable CD player, and because it has an input impedance of 10K ohms, I use it for a portable headphone amp when checking various audio lines.

Timing is critical to the overall sound of your station. Coordinating liners, ads, spots and music can be very trying if your timing is off by even 10 seconds—there isn't much leeway.

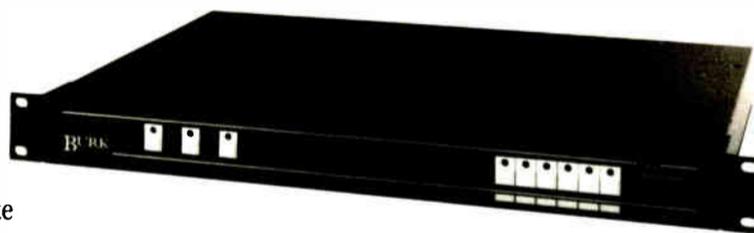
The day we switched to the bird, we made the switch at the top of the hour. It sounded great. When we came out of the first stop-set twenty minutes later it

continued on page 36 ▶

Figure 1.



Now, Burk pushes the right buttons for clean, clear audio switching.



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INSIGHT ON RULES

Is Your STL Gear FCC-Type Compliant?

by Harold Hallikainen

SAN LUIS OBISPO, Calif. On Jan. 12, 1990, the FCC modified section 74.550 of the Rules, delaying the deadline for use of FCC type notified STL transmitters from July 1, 1990 to July 1, 1993. That deadline is approaching quickly.

By that date, stations *must* be using an FCC notified STL transmitter. Most STL equipment made less than 20 years ago does meet the current FCC requirements. I called a few manufacturers for information on which models are compliant as-is, which can be modified to be compliant, and which must be removed from service.

Manufacturers' report

Bext (phone 619-239-8462) says all their STL transmitters are FCC notified. Make sure the FCC ID label is on your unit. Circle Reader Service 55.

Dolby Labs (phone 415-558-0200) also indicates that all their STL transmitters are FCC notified. Circle Reader Service 97.

Marti Electronics (phone 817-645-9163) says the STL-10 is FCC notified and has the required label. A notice of FCC Type Approval is available for the STL-8.

Note that FCC 2.904(d) authorizes use of type accepted, type approved or certified equipment where FCC-notified equipment is required. Circle Reader Service 41.

Micro Controls (phone 817-295-0965) says that PTS-10C and PTS-10N STL transmitters manufactured after Jan. 25, 1990, are FCC-notified and have the required label. Units manufactured before that date can be upgraded, FCC-notified and receive the required label for \$450. Circle Reader Service 167.

Moseley (phone 805-968-9621) indicates

It will not be legal to use a non-FCC-notified STL transmitter after July 1, 1993.

that *very old* STL transmitters (the 101, 303 and 404) are not being upgraded to the current spec. You'll need to replace these units. The 505 can be upgraded for a price between \$0 and \$3,000, depending on the age of the transmitter.

A worksheet is available from Moseley that can be used to determine the cost of the required upgrade. In addition, Moseley offers a \$500 trade-in on the model 505 transmitter when purchasing a new transmitter. This trade-in is available

through Moseley distributors. Finally, it was pointed out that replacement of an old STL transmitter (without replacing the receiver) does result in an audible improvement in the broadcast audio. Circle Reader Service 136.

TFT (phone 408-727-7272) models 7700B, 8300, 8600, 8600A, 9100 and 9200 are FCC notified for use under FCC Part 74 (broadcast STL and intercity relay). Models 9100, 9200 and 8600 are type notified under part 94 (business point-to-point microwave). Stations licensed and operating under part 94 may be used for various program links, including intercity relay, return of program from a transmitter site or *intermediate* STL links. Part 94 licensed stations cannot be used for the "last link" in an STL system. Finally, the TFT model 7700 is not FCC-notified and will require replacement. Circle Reader Service 108.

What to do with old STLs

As the rules are currently written, it will not be legal to use a non-FCC-notified STL transmitter after July 1, 1993. The FCC may consider allowing use of non-notified transmitters on an emergency basis pending the repair of a notified transmitter. I like stations to have as much standby equipment as possible, so it would certainly be nice for the FCC to make such an allowance.

If they do, I'd assume it would be on a non-interference basis and perhaps for some limited period of time. At deadline, the FCC had not determined whether they would make such an allowance, but you may want to consider holding on to your

old STL transmitter.

If you do have a non-FCC-notified STL transmitter in operation now, *now* is the time to figure out what you are going to do. You may wish to purchase a new FM STL transmitter, an entire new STL system or a digital STL system. Perhaps phone lines deserve another look.

With the available digital data compression, most AM stations can easily be handled on 64 Kbps DS-0 circuits. FM stations can be handled on a 1.5 Mbps DS-1 without data compression. They could be handled on fractional DS-1s with data compression. Due to equipment lead times, the decisions need to be made now.

FCC Notification

Note that with "other equipment changes" (other than a change in ERP, frequency, channel bandwidth, transmitter or antenna location, antenna structure height, antenna main lobe direction, all of which require an application on form 313), the FCC must be notified upon completion of the changes. This would be the case when changing an STL transmitter or adding multiplex channels. When adding multiplex channels, the FCC must be advised of the use of the channels (FCC 74.551).

□□□

Harold Hallikainen is president of Hallikainen and Friends, a manufacturer of transmitter control and telemetry systems. He also teaches electronics at Cuesta College, San Luis Obispo and is learning Contra dancing. He can be reached at 805-541-0200. He can also be reached on internet at ap621@cleveland.freenet.edu.

Understanding the Role Of Capacitive Reactance

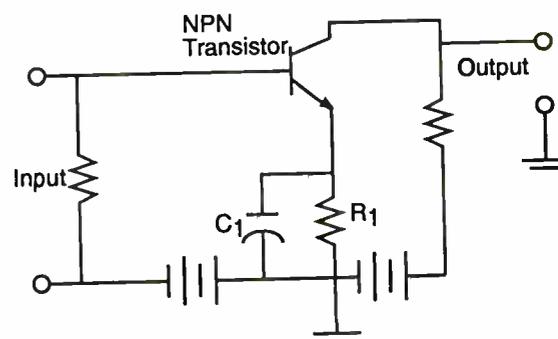
► continued from page 31

capacitive reactance must be taken into consideration. Figure 4 is an illustration of a transistor using emitter biasing. Capacitor C1 is in parallel with the emitter resistor R1. This capacitor is employed to absorb any current variations caused by the amplification process in the transistor.

at the input to an amplifier will prohibit unwanted signals from getting into amplifiers. A capacitor with a reactance near zero ohms at the radio frequency but a high resistance at the amplifier's operating frequencies will often remove the undesired signals.

Test your knowledge: A 5,000 micro-

Figure 4.



It places a constant voltage on R1 stabilizing the transistor's operation. C1 is chosen to have a capacitive reactance that is at least 10 times the value of R1 at the frequency range that the amplifier operates in. This insures that the capacitor will not affect the amplifying characteristic and proper bias operation of the transistor.

Capacitors are often used to remove radio frequency interference from electronic devices. Often connecting a capacitor between the positive lead and ground

farad capacitor has a capacitive reactance of _____ ohms at an operating frequency of 60 hertz.

□□□

Ed Montgomery is a communications teacher at Thomas Jefferson High School for Science and Technology. He has taught broadcast engineering at Northern Virginia Community College and worked as a broadcast engineer for several radio stations. He can be reached at 703-750-5090.

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World Radio History

Do-It-Yourself Amplifiers and Clocks

► continued from page 33

sounded bad, real bad. It was obvious what was happening when we timed the next stop-set. Ten seconds too long.

Keeping time

The staff was in a mad rush to re-dub all of the spots to their correct length. The only piece of gear keeping time in the station was a big Seth-Thomas clock in

ber that a 30-second spot that starts at 12:15:13, will end at 12:15:43.

It was time to go to the workbench. The schematic in Figure 1 was the result. A digital sixty minute timer. With manual start, stop, reset, and automatic reset. I hooked it up to the cart recorder in the production room so that whenever the start button was pushed, it would reset. It made everything sound better.

Since then, I have built and installed one in each of the studios. On our live-assist side, one is hooked-up so that everytime a source is started, it resets. This helps the jocks back-time music on tape. The satellite studio is wired so that everytime the satellite sends the signal to start a stop-set, the clock resets. This scheme is really great when a spot gets blown-off. We know how

much back-fill we need before we rejoin the satellite.

Construction is basic and non-critical. I used Perf board and wire-wrap wire soldered point-to-point. Some may disagree, but Jim's number one rule when using

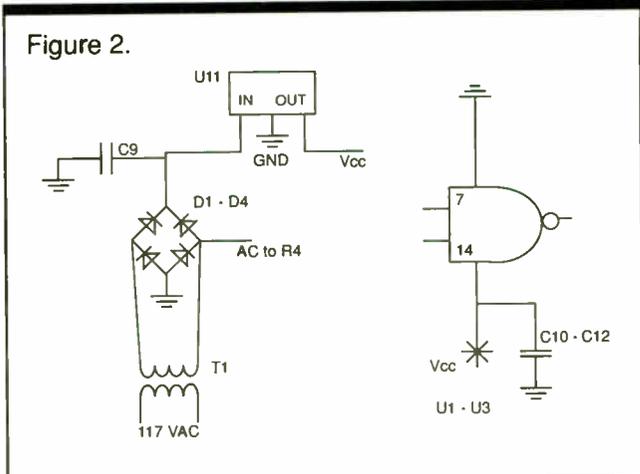
IC's is to use sockets, especially with CMOS devices.

Components are not critical either. I used 1/4 Watt resistors because I had 'em. Caps should be 25 volts or so, and

point, especially the wiring between the drivers (U7-U10) and the displays.

For added stability, you should tie the unused inputs of U1 (pins 12 and 13) to Vcc. Remember also to be very careful

Figure 2.



the production room.

Now it can make you feel real old when one of the part-timers mentions that she has never used anything but a digital clock. Also, with some of the other talent around, it is difficult for them to remem-

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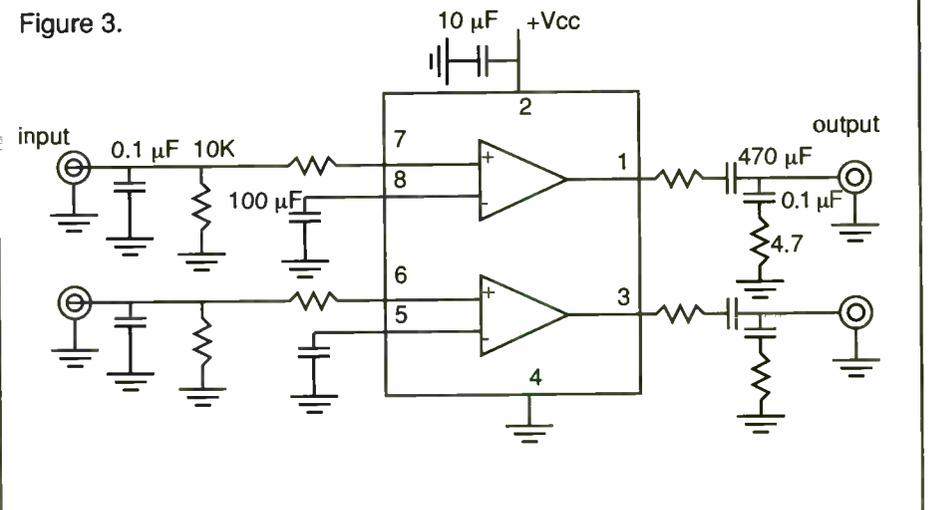
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World Radio History

Figure 3.



except for the filter cap, you can use ceramic or malyr or whatever you have for the by-pass caps.

handling CMOS devices. Use a heat sink for U11.

To construct the timer, you will need the following parts:

Circuit description:

The circuit uses as a time base an AC sample from the power supply. The current is limited by R4 and the voltage is dropped by the R5-C4 combination. The AC is conditioned at U3a and U3b to give U4 a good square wave. One half of U4 divides the 80 Hz signal by 6 and the other half divides by 10 to give a 1 Hz output.

If you are overseas and have a 50 Hz supply, all is not lost. All you have to do is change the line on U3 pin 9 from pin 4 to pin 3 on U4. S1 is the start and S2 is the stop switch. These drive portions of U1 acting in as a flip-flop. S3 is the reset.

If you have any trouble obtaining the 1 Hz output from U4, check the wiring in and around U4. Remember, neatness counts, but there is a limit to how neat this project can be if you wire it point-to-

| | |
|--------------|---------------------------|
| R1 - R6 | 10 K |
| R4 | 57 K |
| R5 | 270 K |
| R7 - R34 | .001 mfd |
| C1 - C3 & C8 | .001 mfd |
| C4 - C7 | .01 mfd |
| C9 | 1000 mfd |
| D1 - D4 | 1N4001 |
| U1 - U3 | 4011 |
| U4 - U6 | 4518 |
| U7 - U10 | 4511 |
| U11 | 7805 regulator |
| TL | 6.3 volt 500 mA |
| S1 - S3 | N.O. push button |
| MISC | Suitable case, IC sockets |

□ □ □

Jim Westrom is an engineer living and working in Juneau, Alaska. He can be reached at 5875 Glacier Highway, #86, 99801.



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If you want to be a winner in the "no win modulation wars", contact your dealer to arrange a demonstration of the Aphex Audiophile Air Chain. You can't buy better quality at any price.

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Circle (161) On Reader Service Card
World Radio History

Calculate Power Density

► continued from page 28

25 meters, the power density would be about 32 percent of the limit ($12/25 \times 0.677 = 32$ percent).

Of course, these are worst-case figures.

sider how close the public can get to the radiating elements of their antenna systems. FCC rules have always required that tower bases be fenced and locked; the question now becomes, how far from

Figure 5.

| Transmitter Power (kW) | | | | | | | | |
|---------------------------------|-------|-------|------|------|------|------|------|------|
| 50.00 | 25.00 | 10.00 | 5.00 | 2.50 | 1.00 | 0.50 | 0.25 | 0.10 |
| 12 | 9 | 7 | 5 | 4 | 3 | <2 | <2 | <2 |
| Distance from Radiator (meters) | | | | | | | | |

If in doubt, measure.

When answering Question 7 on the renewal form, AM operators must con-

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the tower base must the fence be?

The answer is easy. Find the distance corresponding to the power level in the OET 65 chart and be sure your base fence is no closer than that distance to the tower base. Directional stations should fence each tower base at the radius for the total station power, not the specific power in the individual element towers; something could go wrong and put all the power from the transmitter into one tower. However unlikely, this is the safest way to go.

It is also a good idea to specify what steps you will take to safeguard tower workers from RFR overexposure—when tower maintenance or other work is undertaken. Usually, a station either shuts down completely or switches to an auxiliary antenna or separate site safely out of harm's way.

If in doubt...

Although most stations will find proving RFR compliance relatively painless, particularly if only one or two stations use the tower site, there will be cases where simple calculations will show the limit is exceeded. This will usually occur in "antenna farm" situations, on mountaintop sites, and combinations of the two. There are a couple of ways to go if this is the case.

First, hire a consulting engineer to study the situation. He can do a scientific study of the entire site, meter-by-meter, finding

WORKBENCH

► continued from page 32

board is small. If in doubt, ohm out the contacts as you depress the play button.

Run your console remote start wires to a mini plug, and you're in business.

★ ★ ★

As an economic move, we're seeing more stations resort to recording studio mixing consoles for production room or remote broadcast use. One of the engineer's biggest worries is that these consoles have so many knobs and switches. One switch thrown the wrong way can kill a remote—or make the production director want to kill you!

Mike Shoupe of WABS and Fairfax Cable Access put an end to these problems by using a piece of gaffer's tape. For his particular console, someone was always adjusting the output faders. Mike found black gaffer's tape that matched the color of the console trim, removed the slider fader knobs, and after properly positioning the sliders, cut small slits in the tape. The tape was carefully laid onto the console and the slider knobs placed back on the faders. Mike can be reached at 703-358-4021.

★ ★ ★

Between all the LMAs and stations operating with the Motel 6 front desk attendant as "operator on duty," the TEBS's time has come. Mark Persons of M.W. Persons and Associates sent

me some information on this "Tabletop EBS Receiver" that lists for \$350. The receiver/decoder gives full compliance with FCC remote control point EBS monitoring. If you want to provide your own radio, the decoder is available in a stand-alone version.

Another interesting add-on is a remote EBS interface. This rack mounted chassis interrupts normal program audio to insert EBS tones and audio. The REBS-3 was designed for the Sine Systems dial-up remote control, but will work with other dial up remote control systems. The typical use of the REBS-3 is to allow broadcasters to remotely transmit EBS information within five minutes of receipt of an EBS alert. For more information, circle **Reader Service 27**.

□ □ □

Editor's note: Field modifications to equipment may invalidate the manufacturer's warranty. Before attempting any repairs or modifications, consult the manufacturer for advice and guidance.

Always use the utmost care and follow good engineering practices when working with or around electrical equipment. RW will not assume responsibility for any loss or injury.

John Bisset is a principal with Multiphase Consulting, a contract engineering and projects company. He can be reached at 703-379-1665.

the combined power density of all stations at each of hundreds of points.

However, if even such a detailed study cannot show compliance, actual measurements will have to be undertaken. There are several quality organizations that specialize in this type of work. They will divide the site into grids, make detailed scientific measurements, and submit a report to whoever commissioned the study.

With this data in hand, the owners of the

site will have to determine in what areas the ANSI limit is exceeded and construct fences, place warning signs, and otherwise restrict the public and workers from entering these areas. This is a big job, but the good news is that the cost of such a study and remedial measures is usually divided among all the users of a site, thus reducing the cost to each party considerably.

So before you check **NO** on Question 7, first use the tables, then calculate, then call for help.

□ □ □

Cris Alexander is director of engineering for Crawford Broadcasting. He can be reached at Box 561307, Dallas, Texas 75356.

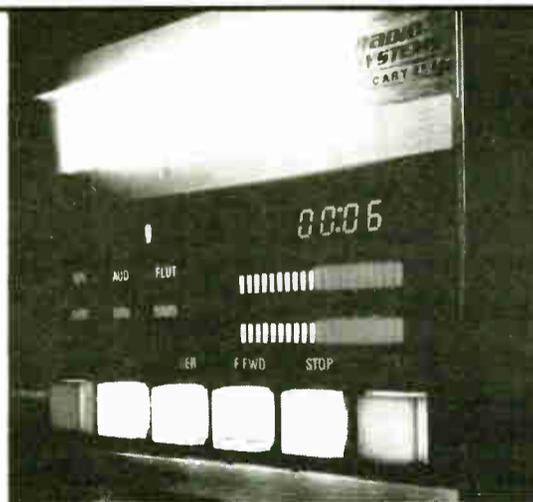
Get Digital Gear In Sync

► continued from page 22

What often happens, however, is that the master timecode source changes during the course of a project. Also, it's a fact of life that most timecode references offer a modest jitter performance. In these circumstances, it is best to avoid using timecode as a master source of frequency lock or timing information. Instead, frequency- and phase-lock the master workstation or editor to a AES11 Reference Signal (or video house sync, if it is available), and only use timecode for cue reference.

□ □ □

Mel Lambert has been intimately involved with the production and broadcast industries on both sides of the Atlantic for more than 15 years. Now principal of Media&Marketing, a Los Angeles-based consulting service for the professional audio industry, he can be reached at 818-753-9510.



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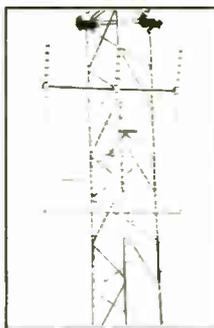
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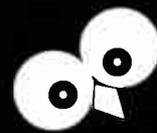
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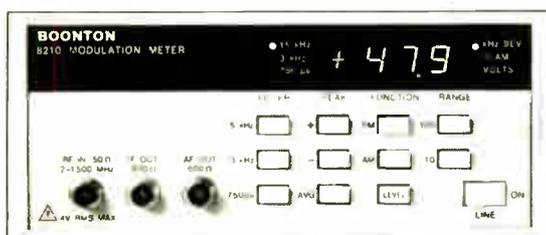
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Dynaco ST120, gd cond, BO. R Robinson, TNA Rcdg, 10 George St, Wallingford CT 06492. 203-269-4465.

Gates MO 2696 rk mnt prof mon amp, c. '50s, \$200. R Franklin, 215-646-7788.

Crown Micro-tech 600LX stereo pwr amp, \$600; DC 300A stereo pwr amp, \$450; Southwest Tech stereo pwr amp, \$175, exc cond. D Lundy, 606-546-6650.

Shintron 220 1x6 DA card, new w/ manual, \$30. D Bailey, Rock Shoppe, 3422 Beech St, Rowlett TX 75088.

New 250 W solid state amp, \$1800. Call for details. Bill Hoffman, 518-583-9490.

RCA, Altec, Dynaco tube amps, sell of trade. Tracy Eaves, 615-821-6099 (evenings before 10PM EST).

ANTENNAS & TOWERS

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Moseley TLK-2 new twr light kit. C Springer, KSEC, Box 390, Lamar CO 81092. 719-336-2206.

Jampro JND-40FMS 2-input diplexer, 20 kW ea w/patching & DL, \$4850+s/h. L Young, WJCT, 100 Festival Park Ave, Jacksonville FL 32202.

ERI M-1105-2A 2-bay FM, 97.7 MHz, \$1200; ERI 5-bay FM horiz, 102.5 MHz, \$1000; 75' of 1 5/8" coax w/1 5/8" EIA flanged conns, \$500; 45' of 1 5/8" coax w/conns, \$350. G Kenny, KCL, POB 932, Neosho MO 64850. 417-451-1440.

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ERI FMXL-2E (2) bays on 92.1 MHz w/ 1/4 wave stub, BO/trade for Rohn 55 170' or (12) bays on 92.3 MHz. R Whitlock, KITE, 838 G Sidney Baker, Kerrville TX 78028. 512-792-4560.

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Jampro JSCP-12 12-bay FM on 100.3 MHz, exc cond. T Toenjes, KTOP, 715 Harrison, Topeka KS 66536. 913-437-6549.

Phelps-Dodge CFM LP2 2-bay, circ polar w/radomes on 105.5, \$750. B Walters, WASE, POB 2087, Elizabethtown KY 42701. 502-769-1055.

Scala HDCA 10 yagi, 102.3 MHz w/75-50 xlfmr, \$150; Sitco FM rcvr, \$150. D Rose, KAAA, 2534 Huala Pai Mtn Rd, Kingman AZ 81401. 602-753-2537.

Phelps-Dodge FMC-2-LP 2-bay, circ polar, FM tuned to 98.3, gd cond; Kintronics PS-1 pre-sunrise/post-sunset cutback, 1 kW max in; Collins phasor for DA-1, 10 kW in 2 cabs & components for ATUs. E Hoehn, KFMZ, 1101 Walnut, Columbia MO 65201.

Want To Buy

Rohn 55 10' sections, 17-20' sections; 12-bay, any make tuned to 92.3 MHz, low pwr, will pick up. G Baker, KITE, 838 G Sidney Baker, Kerrville TX 78028. 512-792-4560.

6-bay circ pol, pref Phelps-Dodge; 3-bay circ pol, both on/near 92.3 MHz; Moseley PC505C rcvcs on/near 949 MHz. K Diebel, KTJC, 1207 Louisa, Rayville LA 71269. 318-728-5852.

FM 103.3 2-bay, pref ERI, 100' cable w/conns & access; 100' free-standing. 305-292-5009.

Rohn 55 in 10' sections, nd 17-20 sections; 12-bay on 92.3 MHz, low pwr, any make, will pick up/pay s+h. R Whitlock, KITE, 838 G Sidney Baker, Kerrville TX 78028. 512-792-4560.

AUDIO PRODUCTION

Want To Sell

Orban 787A prog mic proc w/rem ctrl, \$700; 622B para EQ, \$600, both new cond. J Somich, Somich Prods, 1208 Stoney Run Trail, Broadview Hts OH 44147. 216-546-0967.

Orban 111B reverb unit, exc cond, \$500. L Wilkins, WLWI, POB 4999, Montgomery AL 36104. 205-240-9274.

Ashley SC55 stereo comp limiter; NEI 342 para EQ; Ashley SC68 para notch filter, \$100 ea. V Huey, NGP, 513 W 54th St, NY NY 10019. 212-246-1517.

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dbx 140X (3) 2-chnl type II noise reduc units, BO. J Coursolle, 414-236-4242.

UREI Mdl 530 9-band stereo graphic EQ, \$225. D Lundy, 606-546-6650.

Audio Dig TC-2 dig delay nut, new, \$890; Spare TPA 71 25 W audio mods, \$45 ea/\$100 for 3. D Peluso, KJUL, 2880 E Flamingo Rd Ste E, Las Vegas NV 89121. 702-732-2200.

Symetrix SE-400 para EQ, new, \$450/BO; (2) phase shifters, new, \$250 ea/BO; (2) SG-200 stereo noise gates, new, \$300 ea/BO. J Diamond, Blue Diamond, Box 102C Chubbic Rd RD1, Canonsburg PA 15317. 412-746-3455.

Studio Sound 305 passive filter, sets, Studio Sound 305, matched pair, con-sec #, rack mount, \$250 ea/BO. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

Ashly SC-66 stereo para EQ, exc cond w/manual, \$200. D Bailey, Rock Shoppe, 3422 Beech St, Rowlett TX 75088.

SKL H/L/O variable filter (pair), \$200. W Gunn, 619-320-0728.

Symetrix 501 limiter/compressor (rms & peak limiter, simultaneously), new, \$250; Alesis Quadraverb Plus multi-effects processor, new, \$350; BBE 422A Sonic Maximizer (spectral enhancer), new, \$200. R Payne 313-786-1767.

Prophet 600 syntheizr, \$450; Spectro Acoustics rk mnt 200 W amp, \$150; Crown VFX2 electronic crossover, \$125. W Gunn, 619-320-0728.

AKG 414 P48 like new, \$675; Dynaco 410, 400 W amp, \$400; dbx 1BX expander, \$135. W Gunn, 619-320-0728.

Roland SPH323 phaser, \$75; Rockmann sustainer & stereo chorus/delay, \$350/both. W Gunn, 619-320-0728.

MCI JH110A 2-trk in stand w/sound & vision remote/locator, \$1200; Orban 674A paragrahic stereo EQ, \$600; Foxtex 3070 comp/limiter, \$150; Foxtex 3180 reverb, \$50. W Gunn, 619-320-0728.

TT (Bantam) ADC patchbays, 144 pts, 1 rack sp, \$129; Tannoy HPB385A 15" coaxial monitor pair in cabinet, \$1750; Altec 436A tube compressors, Daven attn, both \$700. W Gunn, 619-320-0728.

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Burwen/KLH 1.7000A dynamic noise filter; 1210A transient noise eliminator. F McNulty, WLS, 190 N State St, Chicago IL 60601.

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Ampex MX10 or MS 35 mixers. W Gunn, 619-320-0728.

AUTOMATION EQUIP

Want To Sell

SMC MSP-12 keybd, mon, brain, switcher, (3) Carousels, (2) racks, \$4000. D Hughes, WZLT, 584 Smith St, Lexington TN 38351. 901-968-9990.

SMC 350 Carousel, exc cond, many, \$175 ea. S Horner, KMRO, 2310 Ponderosa, Camarillo CA 93010. 805-654-0577.

IGM EC 1989 w/ctrlr, Samsung PC progrm, (3) 250 Sono-mag Carousels, interfaces, \$2500. J Parman, WRNZ, 324 W Main, Danville KY 40422. 606-236-7106.

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Schafer 902 w/spare cards, manuals, Epson printer, remotes, (3) SMC 250 24-cart Carousels, Ampex 440 deck, ABC Kartel ctrlr, \$1000/BO+s/h. D Jackson, KSLQ, 2300 Portola Dr, Santa Cruz CA 95062.

SMC DP-2 (4) Carousels, (4) R-Rs, assoc equip & new SMC Otari deck, BO; SMC DT-4 cart encoding data trml w/CRT/BO. C Springer, KSEC, Box 390, Lamar CO 81092. 719-336-2206.

IGM RAM 2K mem, 6 inputs w/Instacart interface, books, spares, gd cond, BO. C Gennaro, WJMS, 222 S Lawrence, Ironwood MI 49938.

IGM EC (3) 24-slot Carousels, (4) Audicord carts; ITC 770 open reel, cabs, PC, printer & latest software; Wegener SAT rcvr for Unistar AM w/TZM switcher & printer, exc cond, \$10K/BO. D Igou, Bdct Eng Cnslts, 8435 Twisted Oaks, Garden Ridge TX 78266.

SMC ESP-L (2) Carousels, (3) carts, (3) SMC tape decks, \$7500. M Pulley, KYOO, 304 E Jackson, Bolivia MO 65613. 417-326-5259.

SMC DP1 w/(2) side by side racks & (3) SMC 250 Carousels & (1) dual play & stereo switcher, \$2800. J Coursolle, WPKR, POB 3450, Oshkosh WI 49034. 414-236-4242.

IGM (5) 24-slot stereo Go-Carts, \$500 ea; IGM-EC switcher, \$750. B Walters, WASE, POB 2087, Elizabethtown KY 42701. 502-769-1055.

Sentry Format w/software, switcher, (2) 48-tray Instacarts, \$6000. G Kalz, POB 7568, KCEZ, Chico CA 95927. 916-342-2200.

SMC RSC-100 random access selector, \$250; SMC 350-RS Carousel, \$200. R Miller, WCNL, POB 68, Virden IL 62690. 217-824-3395.

Cetec 7000 5046 event, video term, 4 random Carousels, \$3500; source cards, \$150 ea. E Moody, KJEM, 216 N Main, Bentonville AK 72712. 501-273-9039.

Harris Syst 90 w/(7) SMC 350 Carousels, (5) ITC 750 R-Rs, \$3500. H Gauthier, WSAR, POB 927, Fall River MA 02722. 508-678-9727.

SMC ESP-1 1982 mdl, exc cond w/PDC-5 clock, DS-20A switcher, Extel printer & manuals, \$1500/BO. B Christie, Grande Radio Grp, POB 907, La Grande OR 97850.

SMC 250, \$100; TS2S tone sensor, \$50; Extel printer, \$50. D Rose, KAAA, 2534 Huala Pai Mtn Rd, Kingman AZ 81401. 602-753-2537.

Go-Carts (2) 42-tray, (1) 78-tray, exc cond, BO. R Fess, WLRB, POB 250, Macomb IL 61455. 309-833-5561.

Cetec Schafer 7000 Lvl 2 VEL printer, (3) audio file/2A 48-tray, \$4000. C Gillespie, WBDY, POB 5009, Bluefield VA 24605.

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JVC BY 110U w/RS 110U rem ctrl, VF 400U viewfinder, manual & servo ctrl, lens 10:1/16:1, cables & access. J McLean, Stagedoor 1, 9915 MacArthur Blvd, Oakland CA 94605. 510-562-4818.

CART MACHINES

Want To Sell

Spotmaster 906-2021 stereo R/P, \$150; Sparta 4620 Century Series stereo R/P, \$100. A Crane, KFLG, 1343 Hancock Rd, Bullhead City AZ 86442. 602-763-2100.

ITC Omega (4) stereo PB, exc cond, \$700 ea. J Chidester, Radio Tech, POB 1897, Glenwood Sprgs CO 81602.

MaCarta (2) R/P; Harris Gates, BO, Mark, 308-382-2800.

ITC Delta I (3) stereo PB, gd cond, \$1100 ea+s/h. E Trevino, 210-544-1600.



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BE 2100 (2) stereo, play, \$600 ea+s/h; BE 2100 CRPS, \$1000+s/h, both very gd cond w/manuals. F Spinenta, KCEA, POB 2385, Atherton CA 94026.

Fidelipac CTR-112 PB, little use, exc cond, \$1800/BO. D Irwin, 510-254-4179.

Tapcaster X700 RP, (5) Audi-Cord Signature series twin decks w/11 cart slots, \$1995/BO+s/h. J Boswell, WKOZ, POB A, Kosciusko MS 39090. 601-289-1340.

Ampro CT-2504 (2) mono PB, \$250 ea. T McNally, WMID, 1825 Murray Ave, Atlantic City NJ 08401. 609-344-0300.

SMC MaCarta 190 (3), \$200 ea. J Morris, WLYF, 20450 NW 2nd Ave, Miami FL 33169.

BE 3000, mono, R/P, \$400. S Keefe, WCNI, CT College, New London CT 06320. 203-447-1296.

Spotmaster 500C R/P & 505C play, clean, working, \$500 both. M Ripley, KOZE, POB 936, Lewiston ID 83501. 208-743-2502.

BE Series 3000 mono PB w/3 tones, gd cond, \$350. G Gabriele, WFOG, 215 Brooke Ave, Norfolk VA 23510.

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BE Spotmaster 500C R/P, gd cond, \$300/BO. R O'Kelly, KORE, 2080 Laura St, Springfield OR 97477. 503-747-5673.

ITC Delta III stereo play & ITC Delta I stereo w/Delta IV rec amp, exc cond, \$2000 ea/BO. J Pierce, KWNR, 1515 E Tropicana Blvd, Las Vegas NV 89119. 702-595-5705.

ITC R/P, mono w/3 tones, desktop, exc cond w/cases, \$600+s/h. J Emmer, Paragon Bdcers, 509 3rd St, Peckville PA 18452. 717-383-1118.

ITC RP, stereo; Audicord mono, \$1000 both. D Rose, KAAA, 2534 Huala Pai Min Rd, Kingman AZ 81401. 602-753-2537.

ITC R/P, \$200; Harris III mono triple-stack, gd cond, \$400. K Thomas, KZUS, POB 568, Toledo OR 97391. 503-336-2126.

BE 5300C tripledeck, stereo, PB, mint less than 50 hrs, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

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ITC 99B & (3) Delta I PBs, gd clean cond, stereo. T McGinley, WPGC, POB 10239, Washington DC 20018. 301-441-3332.

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Revox PR99 MK II (4), new, 1/2-trk stereo play w/25 Hz sensor, \$1100 ea. D Peluso, KJUL, 2880 E Flamingo Rd #E, Las Vegas NV 89121. 702-732-2200.

MCI JH110B 2-trk in factory console, \$1500; (4) Ampex AG440C PB in Ruslang consoles, \$800 ea; Ampex 351 full-trk, mono, Inovonics in Ruslang console, \$500; Ampex AG-350 full-trk, mono, w/spare parts, \$350; Metrotech/Dictaphone 400 low-spdl logging syst, 5 xports, 5 amps, 3 time code gener/decoders, \$1200. J Morris, WLYF, 20450 NW 2nd Ave, Miami FL 33169.

Tascam 234 Syncaset 4-trk w/dbx, 8-chnl AudioCentron mix down console w/reverb, DeltaLab/Yamaha effects proc, \$1500/BO+s/h. J Boswell, WKDZ, POB A, Kosciusko MS 39090. 601-289-1340.

Otari ARS 1000 (4), \$400 ea. P Swint, KIXQ, 2620 Dogwood Rd, Joplin MO 64801.

Magnecorder (2) R/P; Ampex; (2) Revox A77s; TEAC 4-trk, BO, Mark, 308-382-2800.

Revox PR99 2-trk w/roll around console & mon, exc cond, \$100. G Frey, Graphic Sound Studio, 354 Rileyville Rd, Ringoes NJ 08551.

Nakamichi 550 stereo w/pwr sply, case & manual, \$400+s/h. F Spinenta, KCEA, POB 2385, Atherton CA 94026.

ITC 750 (4) 7.5 ips, stereo PB, clean, \$300 ea/\$1000 all. T McNally, WMID, 1825 Murray Ave, Atlantic City NJ 08401. 609-344-0300.

Otari 5050B 4 4-chnl, 1/4, line & mic inputs, sel-sync all chnls in 2 black cases, very clean, \$675/BO; (3) new hds for Ampex 350 full-trk, \$150/BO; (3) new hds for Scully 280 2-trk, \$225/BO; Otari CR-705A 5-button rem ctrl w/20" cable, \$100/BO; Technics M-270X w/2 motors, Dolby & dbx noise reduc, florescent VU mtrs, very clean cond, \$225/BO; Technics M-270-X rem ctrl, \$25. L Snyder, Madera Bdcgt, Box 182, Floral Pk NY 11001. 718-347-2940.

Otari ARS 1000 (4), exc cond w/manuals & 25 Hz tone sensor & cue tone relays, rack, \$475, w/o rack, \$400. R Chambers, KSUE, 3015 Johnstonville Rd, Susanville CA 96130. 916-257-2121.

Sony BVU 50, nds repair, \$150; Ampex AG-440 1/4", 2-trk, stereo, nds meter, \$200. G Kenny, KCL, POB 932, Neosho MO 64850. 417-451-1440.

Tascam 58 8-trk, 1/2", very gd cond, low hrs, XLR in & out, conns for SMPTE lockup w/video, svc manual, \$3000. T Carroll, 212-340-7519.

Otari MX5050 BQII-8, 8-trk, gd cond, \$1500; MKII-4 4-trk, gd cond, \$1000. L Wilkins, WLWI, POB 4999, Montgomery AL 36104. 205-240-9274.

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MCI JH 110A, 7 1/2, 15 & 30 ips, \$1500; Otari MX 5050 Mark III, \$2250; Otari MX 50, \$1100; ITC 750, \$350, all 2-trk, stereo, exc cond. D Lundy, 606-546-6650.

MCI JH-16 24-trk w/Autolocator II, \$7500; JH-100 Series 1" 8-trk w/Autolocator III, \$3900 ea; Scully 280B 1/2" 4-trk in Ruslang cab, \$550; Scully 280B 1/2" 4-trk, \$350. C Baker, Sound Recorders, 9136 Mormon Bridge Rd, Omaha NE 68152.

Ampex ATR-700, exc cond, \$500/BO. L Houck, Rollin Rcdg, 210 Altgelt, San Antonio TX 78201. 512-736-5483.

MCI JH 16 24-trk w/Autolocator II, \$7500/BO+s/h. J Jackson, Sound Recorders, 9136 Mormon Bridge Rd, Omaha NE 68152.

Otari ARS-1000 (5), gd cond, \$700 ea; Audi-Cord stereo rec PB, very gd cond, \$750; (2) IGM Go-Cart 24, gd cond, \$700 ea; Harris 9001, brain, switcher, pwr sply, CRT & kybd, gd cond. R Wynne, 503-882-4656.

TEAC X1000R, recond, clean, \$400; Ampex ATR700, gd cond, low hrs, \$700; TEAC A3340, \$800; Pioneer RT1020L, low use, \$300; TEAC A3300SX, new, \$300. J Parsons, Parsons Sound, 2781 Fayson Cir, Deltona FL 32738. 904-532-0192.

Ampex 350/440 parts, most new; MM 1100 16-trk 15/30 ips, little use, \$6000, both superb cond. M Gore, 415-469-0136.

Tascam DA-50 Pro DAT R/P w/remote & manual, recently overhauled, BO. Steve, 703-998-7729.

Scully 280 parts. R Robinson, TNA Rcdg, 10 George St, Wallingford CT 06492. 203-269-4465.

Otari MTR-12 1/4" 2-trk audio w/center trk time code, showroom cond, \$7575; MRI 2" 24-trk audio test tape, new, \$250. A Pomponio, Legend, 42 Belmont Ave, Belleville NJ 07109. 201-751-9528.

Tascam 32, 2-trk w/rack ears, new in perfect cond, \$1080/BO. R Payne 313-786-1767.

Otari MX 5050-8HSD 8-trk in roll-around console, rem ctrl, 8 new reels; Tascam M50 12x8x2 mixing, low hrs, exc cond w/manuals, \$4800 both. G Jones, SW Mediacast, 110 Sierra Rd, Kerrville TX 78028

Tascam Mdl 32 2-trk, exc cond, \$975; Mdl 32-2B, 2-trk, gd cond, \$500; Studer B-77, 2-trk, gd cond, \$395. Frontier Radio Ntwk, POB 9292, Austin TX 78766. 512-258-7505.

3M M64 1/2-trk, 1/4" stereo, exc cond, 7 1/2, 15 ips, \$1350. J Wells, Sound Arts, 8377 Westview, Houston TX 77055.

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ITC PD2 (2) mono, R/PB, gd cond, \$200 ea. K Thomas, KZUS, POB 568, Toledo OR 97391. 503-336-2126.

Otari MX-5050 MK III 8-trk audio, less than 50 hrs use, exc cond, \$3200. E Thompson, E Thompson Prods, 962 Hymettus Ave, Encinitas CA 92024. 619-436-2112.

Scully 280, \$200. D Wheeler, WJLY, POB 456, Ramsey IL 62080.

Tascam 32 rec/repro, \$895. J Blodgett, WGTF, 308 Westgate Pkwy, Dothan AL 36303.

Tascam/Fostex 8-trk w/(2) Sony CDs, TEAC double cass, (2) Technics SL1200 MKII patch panel, Fostex EQ, Shure SM5 mic, road case, Delta Lab effects, little use, \$4000. D Rose, KAAA, 2534 Huala Pai Mtn Rd, Kingman AZ 81401. 602-753-2537.

Pentagon C4322 duplicator, VU meters, \$300. P Russell, Bowdoin Coll, Sills Hall, Brunswick ME 04011. 207-725-3066.

Revox A-77 mint condition with 3.75, 7.5 ips, 1/4-track, \$325; Ampex 600 & (2) Magnecord PT-6s, Best Offer. C Siegenhaler, KSIW, 612 S 19th Ave, Yakima WA 98902. 509-453-5492.

Ampex ATR700 2-channel, 2-speed, recorder/player, good condition, \$700. B Kidd, Video Productions International, 510 W 2nd, Rayville LA 71269.

Lyrec tape timer 7 1/2, 15 ips, \$50; Yamaha QX5 hardware MIDI sequencer, \$150; Yamaha MDF-1 disk drive, \$150. P Cibley, Cibley Music, 138 E 38th St, NY NY 10016.

Otari MS-80 24-trk, little use, \$16K; Stephens 811D 4-trk, 1/2", \$1700. M Linett, Your Place, 1600 Las Flores Dr, Glendale CA 91207. 818-244-1909.

Revox PR-99 MK II (4) 1/2-track, stereo, play with 25 Hz sensor, \$1100 each; Nortronics CH3-R sensor tape heads, \$10 each/\$50 for 8. D Peluso, KJUL, 2880 E Flamingo Rd Ste E, Las Vegas NV 89121. 702-732-2200.

Ampex 351 (3) full-trk mono, 7 1/2, 15 ips in Ruslang rollabout ea w/Inovonics & Ampex elects, \$500 ea. 908-249-2600.

CLEAN PATCH BAYS NO DOWN TIME



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\$34.95 Ea. Please write for additional information and order form today.

VERTIGO RECORDING SERVICES
12115 Magnolia Blvd. #116 818-907-5161
North Hollywood, CA 91607 fax 818-784-3763

Studer 807 2-trk, 2 yrs old, 3-spd, shuttle whl, \$2950. D Matisy, KLTR, 10333 Richmond #6937, Houston TX 77042. 713-780-0937.

Ampex 30960-02 R/P, tube-type for parts, circa 50s, BO. R Franklin, 215-646-7788

Revox PR 99 MKII (2), \$1600 ea. H Gauthier, WSAR, POB 927, Fall River MA 02722. 508-678-9727.

Otari MX5050 8-trk, custom console, demo, 1/2" tape, \$2500/BO; 8-trk, Ruslang console, new, 1/2" tape, \$3500/BO; 4-trk, custom console, demo, 1/4" tape, \$2000/BO; (3) Technics RSM-65, new, \$250 ea/BO; Sony TC-228 8-trk, new, \$150/BO; Sony TC-777-4, mint, 1/4" trk & tape, \$250/BO. J Diamond, Blue Diamond, Box 102C Chubbic Rd RD1, Canonsburg PA 15317. 412-746-3455.

Ampex ATR700, exc cond w/rack rails, \$500. L Houck, Rollin Rcdg, 210 Altgelt, San Antonio TX 78201. 210-736-5483.

Otari Mark II-IV 1/2" 4-trk, multi-trk, mint, under 50 hrs, BO. R Kaufman, Pams Prods, POB 482247, Garland TX 75046. 214-271-7625, after 3PM CDT.

EMPLOYMENT

To place ads in this section, use the ActionGram form. To respond to box numbers write Radio World, PO Box 1214, Falls Church, VA 22041. Attn: _____

POSITIONS WANTED

Rockland County NY/Westchester CT seeking FT porf inside sales/mktg, exper, proven track rec, refs, hard-working, aggressive, avail immed, \$20K+comm. 914-425-2225.

Maint engineer, experienced, FCC licensed, CET 4 fields, radio/TV, NYC metro area preferred but will travel, NGBER & NGRTE cert. M Rakoff, 114-41 Queens Blvd #148, Forest Hills NY 11375. 718-591-3859.

NY-based musician/composer/ engineer/producer/MIDI with Mac experience & knockout resume seeks pos/freelancd music prod. Rick, 908-241-3275.

On-air/prod, any format, super voice, exper, SE/SW pref, benefits. J Glascock, 813-461-3192.

20 yrs experience in radio announcing/ some sales, sks pos in No AR, E OK, So MO, W MS, No TX. 501-337-7218.

Construction & fix-it engineer, will go anywhere, anytime, available by day/week/project, excellent credentials, US/foreign. 813-849-3477.

33 year old college professor with 15 yreas MD/PD experience, volunteering to assist/run music department, college/alternative station, will improve your servicing, no fee/salary. Rich, 609-232-8427.

Articulate, Dynamic radio talk show host seeks position NY metro area, reliable team player. Write to: Radio World POB 1214, Falls Church VA 22041. Attn: Box # 93-03-02RW.

15 years experience, announcer in all formats except classical, 5 years management exper, willing to relocate, pref s.e. market. Tape & resume upon request. Mike, 703-728-2323.

Construction & fix it engr will go anywhere, anytime, avay by day/week/project, exc refs, US/foreign. 813-849-3477.

Sales & Marketing experts, sensational experience & plan to add \$30K/month min to any station with decent signal & population coverage. 813-849-3477.

Denver Chief Engineer yearns to return to music radio. Strong on new AM methodologies and directionals. 14 years engineering, 12 years on-air. Lifetime license, B.A., other talents. Prefer Contemporary and Country formats. Available now. Reese Hull, 303-623-8313.

Looking for Chief Engineering position, or two contract positions in close proximity, in New England, or Northeast. Major market experience, high power, all facets and years of experience. Write to: Radio World, POB 1214, Falls Church VA 22041. Attn: 93-03-01RW.

Better 1/2 of AM team seeks new position with 22 years experience in all markets. Jim, 915-235-5617.

28 year old w/17 yrs AT experience, 4 years PD/MD, some production, CHR/urban/ dance, will relocate, any market. Bill, 919-793-4376.

Talented radio pro with 25 years experienced, NW stations, will be GM/OM/PD/ production/technical help. Ron, 503-649-1568.

I'm your new voice: young, energetic, quick, witty, great pipes, loaded w/raw talent, exper & good looking. Nelson, 704-542-1089.

Bdct Tech with 8 years experience seeks Asst Chief position, new consinc experience & strong rem experience at your disposal, AASEET/SBE cert pending. 219-489-4284.

Give me a break? College grad interested in sports announcing pos, radio/TV/newspaper background, will relocate, excellent references. D Ranieri, 107 Jarrett Dr, Syracuse NY 13219. 315-487-2910

GM for Fla med/rg market, 29 years exper in sales/prog/engrg, turnarounds/startups, avail immed. 813-849-3477.

Exper in radio & prod, produced own show w/my 60s/70s collection. Ed, 214-986-7006.

Talk show host, exper prof, extensive contacts, conversant, call-in, monologue, interview, mkt size open, salary nego. Michael, 704-632-4621.

PD/morning man looking for med market, on-air pos, will relocate, any format, resume & tape upon request. Sean, 717-928-8205.

Experience broadcaster seeks board oper/prod/air position at CA easy listening/ AC/oldies/ C&W/talk. 714-632-8243.

December grad seeks sports/news position, public & commercial experience, prefer Midwest, will relocate. Rob, 2743 St. Rd. 161, Centralia IL 62801.

Expe & successful group executive, former GM wants to return to station/grp from consulting, will take on problems/interim managemet. 305-935-5057.

HELP WANTED

Chief Engineer—Multi station Illinois group. Send cover/resume. Rollings Communications, POB 882, Chesterfield, MO 63006. EOE.

GM/SM EQUITY POSITION
Possible buyout 3, 7, 9 year plan, AM/FM's in Missouri & Illinois.
Call 217-357-3128 (day)
217-357-6610 (late evenings)
Ask for Dan Bryan

AM/FM COMBO

Excellent small market opportunity. Separate facilities. Established audience. Local & national news, local markets, local & professional sports. Staff in place. Motivated seller. #39009.

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P.O. Box 15046
Austin, TX 78761
(512) 339-0000
FAX: (512) 339-9403

ABOUT OUR EMPLOYMENT SECTION

HELP WANTED: Any company or station can run "Help Wanted" ads for \$1.50/word or buy a display box for \$55/column inch. Payment must accompany insert, use your MasterCard or VISA; there will be no invoicing. Blind box numbers will be provided at an extra charge of \$10. Responses will be forwarded to listee, unopened, upon receipt. Call 800-336-3045 for details.

POSITIONS WANTED: Any individual can run a "Position Wanted" ad, FREE of charge (25 words max), and it will appear in the following 2 issues of Radio World. Contact information will be provided, but if a blind box number is required, there is a \$10 fee which must be paid with the listing (there will be no invoicing). Responses will be forwarded to the listee, unopened.

Mail to: **BROADCAST EQUIPMENT EXCHANGE**
PO Box 1214, Falls Church, VA 22041
Attn: Simone Mullins

CASSETTES & R-TO-R REC...WTS

Sony TC-377 1/4-trk, stereo, open reel, gd elects, \$35. J. Sliite, 404-534-1000.

Otari ARS1000 DC OB, 5 yrs old, exc cond, \$650. B Walters, WASE, POB 2087, Elizabethtown KY 42701. 502-769-1055.

Studer C270/2 2-trk analog mastering, \$2950/BO; HS77 MK IV full-trk mono, 10 hrs use, \$875/BO/trade; port case for A77 w/mn spkrs & pwr amps, exc cond, \$375. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

Tascam 40-4 w/dbx & flight case, \$950; Tascam 48 8 trk, excel for sync, \$2950. W Gunn. 619-320-0728.

Tascam 32 2-trk & 38 8-trk, like new, \$2000/both; Teac 3340 4-trk, 1/4" deck, \$375; Tascam 80-8 8-trk never really used/perfect, \$1600. W Gunn. 619-320-0728.

Ampex ATR800 mono, like new, \$1200 & AG440-8 1" 8-trk; Otari 7800 1" 8-track, \$2900. W Gunn. 619-320-0728.

Scully 270 14" PB, 1 stereo plus 1 mono for parts, \$200/both; Ferrograph Super 7, 10", 3-7-15 ips, 2 trk, \$300. W Gunn. 619-320-0728.

Want To Buy

Magnecord PT6-6A rec amp, gd working cond. B Berry, Karavan Bdcg, 13 Montgomery Pl, Conroe TX 77284.

Otari MK III-8 head bridge with out heads. R Robinson, TNA Rcdg, 10 George St, Wallingford CT 06492. 203-269-4465.

Nakamichi LX-5 3-hd. J Mueller, Family Stations, 290 Hegenberger Rd, Oakland CA 94621.

Nagra 3S/4S w/NAB hds; Sony TC880/8750; ReVox B215. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

Scully '100' recorders, record/play amplifiers, 8, 16, 24 trk hds. Sequoia Electronics, 1131 Virginia Ave, Campbell CA 95008. 408-866-8434.

Ampex ATR100 taperecorders for parts. Circuit cards, heads, motors, machine parts, or electronic parts. Call 818-907-5161.

CD's/PLAYERS**Want To Sell**

Denon 950F. (2), gd cond, \$1100 ea+s/h. E Trevino, 210-544-1600.

Audiometrics CD-10, less than 1 yr old, \$1000; many caddies. R Rogers, KSKG, 1217 S Santa Fe, Salina KS 67401.

Technics SL-P1200 (3), \$600 ea. A Garza, Goster Comms, 2824 Sherwood Way, San Angelo TX 76901.

Want To Buy

Denon 2560/DCD970/DCD660/other w/varispd, R Robinson, TNA Rcdg, 10 George St, Wallingford CT 06492. 203-269-4465.

COMPUTERS**Want To Sell**

Tandy 4P (3) ports, working, \$100 ea/BO. J Boswell, WKOZ, POB A, Kosciusko MS 39090. 601-289-1340.

DigiDesign Sound Tools II w/DAT I/O mod, sound accelerator card, (2) 640-meg La Cie hard drives, v2.3 software, \$4900. C Baker, Sound Rcders, 9136 Mormon Bridge Rd, Omaha NE 68152.

RCA APT term, modem, software, dig LA-50 serial bus printer & manual, \$300. R Franklin, Franklin Studios, 1004 Dekalb St, Norristown PA 19401.

CONSOLES**Want To Sell**

Arrakis 1505C (2), 3 mos old, mint cond, 6-chnl mono, \$3000 both; cart machines. J Hart, Radio Genesis, 13701 W Jewell Ave #111, Lakewood CO 80228. 303-987-1211.

Ramko DC 38-85 8-chnl, fair cond, \$1500. D Rose, KAAA, 2534 Hualapai Mtn Rd, Kingman AZ 86401. 602-753-2537.

Shure M267, gd cond, \$275. G Gabriele, WFOG, 215 Brooke Ave, Norfolk VA 23510.

Auditronics 24x16x4 console w/Producers desk & 624-part patch; Orban 245 stereo synth; dbx 463x noise gates in rack mount; 3M Mincom 1/4" full-track in console; Scully 280 1/4" 2-trk R/P, mono; Dynex 240 noise supp; Orban Mdl 526A; 622B 2-channel EQ; Aphex 602 aural exciter; Auditronics PEQ 82 dual EQ; Scully 280 1/4" full-track in console; 360 Syst prog EQ w/28 memory; Lexicon 1200 time compressor; UREI 964 dig metr-ome; Burwyn DNF 1500A noise reduc 8K; Kepex rack w/5 Gates & 1 Imtr; Scully 280 4-trk 1/2", \$5950. 202-338-0770.

RCA/Ampro BC-15 spot mono, solid state, clean, \$350. T McNally, WMID, 1825 Murray Ave, Atlantic City NJ 08401. 609-344-0300.

Spotmaster 8-chnl; Ampro 6-chnl; Collins 212E-1, BO. Mark, 308-382-2800.

RCA BT-3-B 9-pot board, some ext modifications, \$200/BO. D Jackson, KSLO, 2300 Portola Dr, Santa Cruz CA 95062.

Tascam 216 16-chnl, new cond, \$950. B LeCato, WMYJ, 1508 Market St, Pocomoke MD 21851. 410-957-4300.

Ward Beck L2042 13 in, expand to 20, effects, send, EQ, solo each chnl, 6 out, separate mon mixdown, \$10K/BO. J Morris, WLYF, 20450 NW 2nd Ave, Miami FL 33169.

Tascam M-216 16x4x2, live/rec board, exc cond, \$800. B Rico, Matrix Syst, 1056 Paula St, San Jose CA 95126.

Lindy Williams 9-chnl w/2 inputs per chnl, sml outboard pwr sply, one meter defective, \$800. K Thomas, KZUS, POB 568, Toledo OR 97391. 503-336-2126.

Russco 505M 5-rotary fader mono bd with 2 inputs switchable internally, 1 input line, built-in mon, cue, head-phone amps, rack mountable with desktop case, exc cond, \$600/BO. R O'Kelly, KORE, 2080 Laura St, Springfield OR 97477. 503-747-5673.

Sound Workshop Logex 8 16-chnl w/EQ cntrs, BO. D Coffman, WSOR, 940 Tarpon St, Ft Myers FL 33916.

Auditronics 110A 14x4, clean w/book & parts, \$800/BO. G Foldessy, WAKR, 1735 S Hawkins Ave, Akron OH 44320. 216-869-9800.

Tascam Mdl 15, 24x8 w/8 input, \$3000; Neotek Series I, 16x8x2, very clean, quiet, \$3000. C Baker, Sound Rcders, 9136 Mormon Bridge Rd, Omaha NE 68152.

Ramko DC5AR 5-chnl, mono, record, \$350; Altec 1592B, 5-chnl, mono, clean w/plug-ins; Grommes Prec M5, 5-chnl, mono, new, \$275. J Parsons, Parsons Sound, 2781 Fayson Cir, Deltona FL 32738. 904-532-0192.

Ramko DC 8MS 8-chnl, stereo, exc cond+extras. D Lundy, 606-546-6650.

Tascam M216 16x4x2, 1 aux, 2 yrs old, mint cond, \$875. B Rico, Matrix Syst, 1056 Paula St, San Jose CA 95126. 408-297-6056.

TAC/Amek Scorpion audio w/32 inputs, excellent condition with ext card & spare S1001 input mod, \$8975. A Pomponio, Legend, 42 Belmont Ave, Belleville NJ 07109. 201-751-9528.

Presto 900 A1 circa 40s disk/tape w/3 mic ins, large VU, spare tubes, \$250. R Franklin, 215-646-7788.

Cetec Centurion 12-chnl, 2 boards, 1 working/1 parts, \$2500/both & spares. E Moody, KJEM, 216 N Main, Bentonville AR 72712. 501-273-9039.

Tascam 15 16x8x2 w/8 input chnl, \$3000/BO+s/h. J Jackson, Sound Recorders, 9136 Mormon Bridge Rd, Omaha NE 68152.

Ward Beck 24-input broadcast/prod, fully para EQ, very clean, \$5000/BO. R Friedman, 1137 Rcdg, 1137 Fillmore St, Balto MD 21218. 410-889-4228.

Gates Yard Board, painted white, \$300; Bogen CSM remote mixer, \$125. W Gunn. 619-320-0728.

Want To Buy

RCA BC 7A/8A/9A. G Patschke, KIJJ, Box 458, Farwell TX 79325.

24-32 chnl mon board w/8 sends. B Wilson, 906 W Main, Campbellsville KY 42718.

Ward Beck R1200/R2000 stereo input mods. B Taylor, KISS, POB 292, Miami AZ 85339. 602-425-7186.

DISCO & SOUND EQUIPMENT**Want To Sell**

Gemco SG-800 (10) 8" JBL spkrs. \$10 ea. P Russell, Bowdoin Coll, Sills Hall, Brunswick ME 04011. 207-725-3066.

Yamaha QX-5 MIDI sequencer w/MDF-1 disk drive for storage, \$150 ea/\$250 both; Roland SBX-80 MIDI synth box; SMPTE TC reader/gener, \$400. P Cibley, Cibley Music, 138 E 38th St, NY NY 10016.

AB Systems 301 spkr switcher, new, \$250/BO; (2) 205A stereo pwr amps, 200 W, new, \$500 ea/BO. J Diamond, Blue Diamond, Box 102C Chubbic Rd RD1, Canonsburg PA 15317. 412-746-3455.

Snake, 16-phantom-pwr inputs w/ext ps, 250' Belden 19-pr cable/mil conns/SS strain reliefs, 10' Neumann XLR snake mates w/box & Belden snake, exc cond, \$950/BO/trade. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

TOA SM-60 (6), dual spkr w/stands, \$100 ea/BO. J Diamond, Blue Diamond, Box 102C Chubbic Rd, Canonsburg PA 15317. 412-746-3455.

EMT 140 (2) plate reverbs, mono in, stereo out w/motorized damper, rem meters, modern opamps, \$7800 ea. C Baker, Sound Rcders, 9136 Mormon Bridge Rd, Omaha NE 68152.

dbx 208 8-chnl noise reduc, new, \$1500/BO; 154 & 155 4-chnl noise reduc in same rack, mint cond, \$600 both/BO; Soundworkshop 262 stereo reverb, new, \$500/BO; ART DR1 & 01A dig reverbs, new, \$750 ea/BO; (2) Loft 450 delay line/flangers, new, \$400 ea/BO; (2) Nexus 96-pt patch bays, new, \$300 ea/BO; ADA 2.56i dig delays, new \$750 ea/BO. J Diamond, Blue Diamond, Box 102C Chubbic Rd RD1, Canonsburg PA 15317. 412-746-3455.

Sound & Light Disco III mixer, like new, \$300. J Stemke, Studio Sonics, 450 W Rand Rd, Mt Prospect IL 60056. 708-670-0025.

UA 1108 (10), \$100 ea; (12) UA 508 EQ, \$65 ea; (4) Angus graphic EQ, \$400 ea; (2) APSI 559 graphic EQs, \$225 ea; (2) APSI 562 param, \$200 ea. M Linetti, Your Place, 1600 Las Flores Dr, Glendale CA 91207. 818-244-1909.

EV SH-1502-ER 2-way mobile loudspeakers, 15" woofer, titanium driver horn in carpet covered cab with handles, corners & rubber ft, 800 W peak, 200 W power capacity, new cond. B Fisher, KPOK, Box 829 Bowman ND 58623.

Digitech VHM5 Vocalist, new in box, sell/trade for studio vocal mic/qual acoustic guitar, \$500. M Miller, 614-533-0636.

Altec 1568A, matched pair, \$950/BO; Marantz 8, \$1450; McIntosh MC240, \$1200; MC225, \$750; MC40, \$600; A116, \$600; Nak Stasis PA7aMk2, \$1750; PA7A, \$1150; NRG PA1, \$4500/BO/trade. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

JBL 4311 pr spkrs, mint, \$750/BO. J Diamond, Blue Diamond, Box 102C Chubbic Rd RD1, Canonsburg PA 15317. 412-746-3455.

Dolby 301 A-type stereo, discrete, \$500. W Gunn. 619-320-0728.

dbx 155 4-chnl encode/decode, type 1 noise reduc, \$200. P Cibley, Cibley Music, 138 E 38th St, NY NY 10016. 212-986-2219.

Want To Buy

Peavey FH-2 (2) bass cabs, gd cond w/ or w/o spkrs. S Wood, Media Arts, POB 1360, Kailua HI 96734. 808-236-1111.

Crown EQ2 Sony SEQ555ES/333ES; Technics SH9090; dbx 10/20, 20/20, 14/10 EQ; Yamaha REV5/REV7; Burwen TNE7000. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

FINANCIAL SERVICES**Want To Sell**

EQUIPMENT Financing, Lease Purchase Option. Need equipment for your radio, television or cable operation? New or Used. No down payment. Carpenter & Associates, Voice 501-868-5023 Fax 501-868-5401.

LIMITERS**Want To Sell**

UREI 1176LN mono peak, \$450; Mdl 1178 stereo peak, \$650; Mod Sci CP-803 comp clipper with rack mnt, \$350, all exc cond. J Somich, Somich Prods, 1208 Stoney Run Trail, Broadview Hts OH 44147. 216-546-0967.

Orban 424/A dual-chnl comp/lmtr de-esser, mint cond, \$600. A Gregory, 415-285-1953.

UREI LA-3A (2) universal audio, exc, \$800. D Lundy, 606-546-6650.

Aphex bdct aural exciter; CRL SMP 800 & SG 800 stereo gener, BO. J Pierce, KWNR, 1515 E Tropicana Blvd, Las Vegas NV 89119. 702-595-5705.

Inovonics MAPII AM system w/wide-band AGC, 8-band compression, AM peak, phase rotator & positive asymmetry, needs ext NRSC device, \$400. R O'Kelly, KORE, 2080 Laura St, Springfield OR 97477. 503-747-5673.

Ashley CL50 peak detectors, exc cond, \$125 ea/BO+s/h. J Emmer, Paragon Bdcers, 509 3rd St, Peckville PA 18452. 717-383-1118.

CRL SMP800 AGC with filters, \$1000; Optimod 8000, very good condition overhauled, \$1500. R Rogers, KSKG, 1217 S Santa Fe, Salina KS 67401.

Optimod 8000A, \$1500; CBS Volumax 4110 stereo AGC, \$150; CBS Audimax 4450 stereo complim, \$150; (2) Marti CLA-20/40 complim, \$100 both. R Miller, WCNL, POB 68, Virden IL 62690. 217-824-3395.

Gregg Labs 2530 (3) old tri-bands. J Nelly, KHTR, 4187 Wawawai Rd, Pullman WA 99163.

Harris/Gates M-6543 w/manual, \$75. T Rosen, KBCG, 1129 Acacia, Bakersfield CA 93305.

ORBAN 9000-AM Optimod NRSC in excellent condition. Call 816-635-9599.

Want To Buy

**WE BUY
OPTIMOD 8000 & 8100
414-482-2638**

MICROPHONES**Want To Sell**

EV RE-20, exc cond, \$300; (3) Shure SM58, avg cond, \$70 ea/\$200 all. J Somich, Somich Prods, 1208 Stoney Run Trail, Broadview Hts OH 44147. 216-546-0967.

Sennheiser 421, gd cond, \$250. G Gabriele, WFOG, 215 Brooke Ave, Norfolk VA 23510.

Sennheiser 441 (matte), new w/all papers & response curves, \$470; Neumann U87Ai (satin), new w/all papers & Gotham box, \$2100. R Payne 313-786-1767.

EV 635, exc cond, \$50/BO. J Diamond, Blue Diamond, Box 102C Chubbic Rd, Canonsburg PA 15317. 412-746-3455.

Sony ECM-33FP, (2), new, \$200 each; (6) ECM-22, mint, \$150 each/BO; (2) C-22, mint, \$150 each/BO; (6) ECM-21, mint, \$100 each/BO; Fostex M55RP, new, \$350/BO; (3) AKG D2000E, ball-type w/on-off switch, new, \$125 each/BO. J Diamond, Blue Diamond, Box 102C Chubbic Rd RD1, Canonsburg PA 15317. 412-746-3455.

Neumann U67 (2) w/pwr splys & cables, \$2400; (2) U87s, consecutive, \$1250, all gd cond. J Wells, Sound Arts, 8377 Westview, Houston TX 77055.

Audio Technica 813R cardioid, excellent condition with cases, \$125 ea/BO+s/h. J Emmer, Paragon Bdcers, 509 3rd St, Peckville PA 18452. 717-383-1118.

Telefunken/Schoeps CM61 tube mic, orig ps, new cable, mint cond, \$3475/BO; CR-176 Irg diaphragm tube, new, \$1250. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

RCA 44BX, gd cond. M Rice, Contemp Media, 222 Indacorn Dr, St Peters MO 63376. 314-928-6569.

EV RE-11, \$95; C090 lo-Z, lav condenser, exc cond, \$80. D Lundy, 606-546-6650.

Telefunken M921 dual (2-way, not front/back) nickel capsules, cardioid only, classic tube mic; Neumann KM84 pair, mint, \$1100. W Gunn. 619-320-0728.

Telefunken M-250, U-67, 221-A; Neumann U-67, KM-56, UM-57; RCA KV3A-10,0001, 44-BX, 77-DX, BK-4, BK-5, 74-B, varicuts; Altec M-20, M-11, M-30 tube type mics. Trade or sale. Tracy Eaves, 615-821-6099 (evenings before 10PM EST).

Telefunken tube mic pre amps V-76, U-73 limiter's; RCA BA-21As, BA-1As; Altec tube mic-pres. Tracy Eaves, 615-821-6099 (eves before 10PM EST).

EV 676 supercardioid mics 3/\$200; EV RE10 mic, \$125. W Gunn, 619-320-0728.

PHONE: 703-998-7600 FAX: 703-998-2966



Call Simone Mullins, Classified Ad Manager, to reserve space in the next issue. Use your credit card to pay, we now accept VISA and MASTERCARD.

RadioWorld

5827 Columbia Pike, Ste 310
Falls Church, VA 22041

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CD's
CD Players
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77-DX's, 44-BX's, KU-3A's On-Air lights. Top price pd. Fast response. Bill Bryant Mgmt, 2601 Hillsboro Rd, G12, Nashville TN 37212. 615-269-6131.

RCA 77DXs/44BXs ribbon, chrome/TV grey, gd cond, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625, after 3PM CDT.

MISCELLANEOUS

Want To Sell

Teltronix TL-5 telephone info syst, 2 decks, like new, \$150. C Ratliffe, WADE, POB 1210, Wadesboro NC 28170.

1-6' rack; 6-7' rks; (3) R-R rks, BO; 24 VDC pwr sply. Mark, 308-382-2800.

Sharp XV-100 LCD proj w/screen, 100" p ct, warranty, \$2500. B Rico, Matrix Syst, 1056 Paula St, San Jose CA 95126.

Audio Dig Mdl TC-2 dig delay unit, new, w/o manual, \$890 ppd UPS; (3) new, up timers, 2" readouts, \$57.50 ppd; Sparta Elec misc audio & RF tech manuals; (3) Sparta TPA 7-1 25 W audio mods, \$45 ea/\$100 for 3; (8) Nortronics Sensor tape hds Mdl CH3-R, \$10 ea/\$50 for 8. D Peluso, KJUL, 2880 E Flamingo Rd #E, Las Vegas NV 89121. 702-732-2200.

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Bell telephones (2) desk sets, tan, TT & 6 push buttons for 5 lines & hold, new w/cable & 50 conn, \$50 ea/\$85 both/BO. L Snyder, Madera Bldg, Box 182, Floral Pk NY 11001. 718-347-2940.

WE 189D, \$35/pr; UTC LS-141 hybrid, new, \$50; UTC LS-33 20W line, \$100/pr; Cinema Engrg 64266, \$30/pr, lrg Anvil rack case w/whis, 6' high, \$1000. R Robinson, TNA Rcdg, 10 George St, Wallingford CT 06492. 203-269-4465.

RCA M1-11718-1 lighted studio sign w/on-air glass. M Neff, WARM, Wilkes-Barre Scranton Hwy, Avoca PA 18641. 717-655-2271.

Jennings 650PF vacuum-variable capacitor & xmtr-type capacitors, inductors. R O'Kelly, KORE, 2080 Laura St, Springfield OR 97477. 503-747-5673.

King Mdl 300 audio cass loader mod w/seq ctrls, air & vacuum, \$550. D Lundy, 606-546-6650.

Svc/instruc manuals (60) on consoles, carts, cameras, BO+s/h. S Delahoyde, Box 33063, Phoenix AZ 85067.

WE & UTC (3) RC-111C; (2) REP 111D; (2) LS-10; (2) LS-140; (2) LS-27; (2) LS-30X, \$25 ea. L Smith, WCSS, 6 Genesee Ln, Amsterdam NY 12010. 518-843-2500.

Rotron Blowers for Elcom, CCA, CSI, McMortin, rebuilt & new. Goodrich Enterprises Inc. 11435 Manderson St Omaha, NE 68164 402 493 1886 FAX 402 493 6821

Subcarrier Pager syst, Spantel dial access paying terminal & Zetron Mdl 55 voice storage unit w/15 pagers, \$2500/BO. J Boswell, WKOZ, POB A, Kosciusko MS 39090. 801-289-1340.

Up timers w/2" readouts, \$57.50; Sparta audio & RF tech manuals. D Peluso, KJUL, 2880 E Flamingo Rd Ste E, Las Vegas NV 89121. 702-732-2200.

Alertite 3V on-air warning light, new, \$50. R Franklin, 215-646-7788.

Want To Buy

Bdct News magazine, back issues from 40s-60s. B Mitchell, 84-39 153rd Ave #5C, Jamaica NY 11414. 718-738-9223.

Sangamo G1B mica capacitor, .002 MFD, peak working voltage 60900, 11 amps at 1 kHz/equiv, 3 1/4" mounting. B Dickerson, WEAG, 1421 S Water St, Starke FL 32091.

Bogen/Quickset 3067/8 trips & dollies; Clearcom MS-2000C/other intercom syst. J McLean, Stagedoor 1, 9915 MacArthur Blvd, Oakland CA 94605. 510-562-4818.

Gener xfer switch, 200 amp, 1/3 ph, auto. E Davison 217-787-0800.

UTC LS-10X, 12X, LS-15X, LS-18, A-10-12, A-24-26; W Electroacoustic schematic mic #120A; Hycor 4201 passive EQ; Gates Sta-Lvl M5167 Imtr schematic; Gates M3529B Imtr schematic; CBS Decibel Mir Mdl 600 schematic. R Robinson, TNA Rcdg, 10 George St, Wallingford CT 06492. 203-269-4465.

Radio transformers by Chicago, UTC, Triad, Peerless, Freed, Sola, send list. J Gangwer, 942 32nd St, Richmond CA 94804. 415-644-2363.

Jazz record collections, 10" LP/12" LP be-bop, swing, dixie, highest prices paid. B Rose, Program Recdgs, 228 East 10th, NANY 10003. 212-674-3060.

MONITORS

Want To Sell

Belar AM RF amp/mod mon, BO. Mark, 308-382-2800.

Harris AM stereo/mono mod mon STM-1, exc cond, \$1000/BO. L Robinson, WPAX, POB 129, Thomasville GA 31799. 912-226-1240.

TFT 763 & 764A, working, \$500/BO. G Foldessy, WAKR, 1735 S Hawkins Ave, Akron OH 44320. 216-869-9800.

Want To Buy

Belar AMM 1/2, gd cond w/manual. R Miller, KUAU, 490 Ujumalu Rd, Haiku HI 96708. 808-572-5534.

Any older McMartin mod monitors. C Goodrich, 11435 Manderson, Omaha NE 68164. 402-493-1886.

MOVIE PROD EQUIP

Want To Sell

Pathe Prof Reflex 16 gd cond, BO. G Arion, GRA Assoc, 63-37 Wetherole St, Rego Pk NY 11374.

Stancil Hoffman 16mm mag rec w/mon & Scully 280 Series rec elects w/2nd transport, \$350. C Baker, Sound Rcdrs, 9136 Mormon Bridge Rd, Omaha NE 68152.

RECEIVERS & TRANSCEIVERS

Want To Sell

TFT 760 EBS tone gener, decoder, AM rcvr, \$300. T McNally, WMID, 1825 Murray Ave, Atlantic City NJ 08401. 609-344-0300.

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McIntosh MR77, beautiful, \$475. G Gabriele, WFOG, 215 Brooke Ave, Norfolk VA 23510.

Sony SRF-A1 AM stereo Walkman, new, \$89 ea. C Fox, WOLF, 4853 Manor Hill Dr, Syracuse NY 13215. 315-468-0908.

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RECEIVERS & XCEIVERS ...WTS

Sony STJ-75 FM tuner, 8 push buttons, seek/scan, 75 ohm coax & 300 ohm twinlead input, new condition, \$175/Best Offer. L Snyder, Madera Broadcasting, Box 182, Floral Pk NY 11001. 718-347-2940.

AM STEREO RECEIVERS
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 708-513-1386

Microwave Assoc VR-3X C-band with mono subcarrier audio card tuned to 5.01 MHz, excellent condition, \$200/Best Offer. R O'Kelly, KORE, 2080 Laura St, Springfield OR 97477. 503-747-5673.

Want To Buy

Avcom SCPC-200E rcvr. J Coursole, 414-236-4242.

REMOTE & MICROWAVE EQUIP

Want To Sell

Marti RMC-15 16-channel, excellent condition, 3 pieces with manual, \$500. D Igou, 8435 Twisted Oaks, Garden Ridge TX 78266.

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Silver Lake Audio
 (516) 623-6114 FAX: 377-4423

Moseley WRC 25 wire remote control, tube type, good condition, \$200. D Rose, KAAA, 2534 Hualapai Mountain Rd, Kingman AZ 86401. 602-753-2537.

Moseley TRC-15 15-chnl w/Haliikainen dig retrofit, \$600. J Morris, WLYF, 20450 NW 2nd Ave, Miami FL 33169.

Gentner SPH4 hybrid, good cond. \$300. G Gabriele, WFOG, 215 Brooke Ave, Norfolk VA 23510.

Gentner EFT-3000 (4) 3-line digital frequency extenders, good condition, \$5500 each/BO. T Portzline, Broadcast Equities, 1000 Centerville Tpke SHB-213, VA Bch VA 23463. 804-523-7695.

Marti RMC 15S transmitter remote control with manual, \$450. R Chambers, KSUE, 3015 Johnstonville Rd, Susanville CA 96130. 916-257-2121.

RENTALS RENTALS RENTALS
COMREX
 3-line extender
 Frank Grundstein 215-668-6434
 Audio/Video Consultants 215-642-0978

Moseley 303 (2) transmitters & receivers, working. K Kuenzie, KSLQ, 511 W 5th St, Washington MO 63090. 314-239-6800.

Moseley MRC 1600, excellent condition, \$2000/Best Offer. J Pierce, KWNRR, 1515 E Tropicana Blvd, Las Vegas NV 89119. 702-595-5705.

Marti STL-10 transmitter & receiver with 2-4" dishes, 500' of 1/2" & 3/8" coax, \$1500 + assume payments. C Raliffe, WADE, POB 1210, Wadesboro NC 28170.

Comrex LX-T & LX-R frequency extenders, single-line, decoder with rack mount, \$650/pair. R O'Kelly, KORE, 2080 Laura St, Springfield OR 97477. 503-747-5673.

Intraplex TDM-153 T-1 system with 2-15 kHz, 3-7.5 kHz, 3 voice mods per side & CSUs, 9 months use, BO. R Russ, KBLA, 1700 N Alvarado St, Los Angeles CA 90026.

Want To Buy

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SATELLITE EQUIPMENT

Want To Sell

Wegener SCPC rcvr with 1601 mainfr & w/1 ea 1608-22, 1689-05, 1610, 1610-01, 1646 & 1601 cards, BO. J Coursole, 414-236-4242.

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Zephraus 300 Series with 3-freq tone decoder. K Diebel, KTJC, 1207 Louisa, Rayville LA 71269. 318-728-5852.

STS consumer units, stereo audio, matching positioners, \$50 ea. G Gabriele, WFOG, 215 Brooke Ave, Norfolk VA 23510.

Schafer Dig w/3 Beta dks, 660 MB hd drv, \$16K. G Katz, POB 7568, KCEZ, Chico CA 95927. 916-342-2200.

Microdyne 1100-CSR sat/TV receiver, looks new, BO. R Fess, WLRB, POB 250, Macomb IL 61455. 309-833-5561.

SCPC SATELLITE AUDIO RECEIVE EQUIPMENT: New & used, many brands, complete units, downconverters, commercial LNB's. All in exc condition, gd prices, perfect for low cost SCPC uses. SASE for list. Universal Electronics, 4545 Groves Rd #13, Columbus OH 43232. 1-800-241-8171.

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STATIONS

Want To Sell

FM Station in North Italy, 15km from Milan & 20 from Suisse, 3 freqs: 92.450/91.800/93.600. \$480,000US\$. Radio Serena, R.S.33 s.a.s., Via Genova 28, Busto Arsizio (VA) 21052 Italy.

Major San Fran CA FM has subcarriers avail, broker particip encouraged. J Jacob/D Evans, 415-695-5740.

50 kW AM in Capital City, clear chnl, mid/low dial pos, unlit lime non dir, days dir, nights, sale/lease. 501-470-1525.

STEREO GENERATORS

Want To Buy

CCA SG-1E composite for CCA FM-40E, working/hot OK, papers req. C Dunnam, Linear Rsch Assoc, 5244 Perry City Rd, Trumansburg NY 14886. 607-387-3411.

SWITCHERS (VIDEO)

Want To Sell

SMC DS-20 20-event, manual & auto-matic for DP-2, \$500. P Swint, KIXQ, 2620 Dogwood Rd, Joplin MO 64801.

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Want To Sell

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Bonneville lite/AC library, pristine cond, 101+ disks, \$2500. T Backer, WXHC, Box 386, Homer NY 13077. 607-749-9942.

Ampex 456, new, blank, 1/4" on 10 1/2" reels w/boxes. Forest, Musical Starstreams, POB 1989, Seona AZ 86336. 602-204-1989.

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62- & 92-min (100) audio, bulk erased, \$.05 ea. L Houck, Rollin Rcdg, 210 Altgelt, San Antonio TX 78201. 512-736-5483.

Ampex 456 (2) 10 1/2"; (30) used 10 1/2", (171) 7" open reels, (57) blank 7" hubs, trade/BO. J Benjamin, JC Enterprises, 3923 E Thunderbird Rd #139, Phoenix AZ 85032. 602-331-3860.

Mastercarts (200), gold, various lengths, \$1 ea; (300) gray from 70s, \$.50 ea. J Callow, WAGN, 413 10th Ave, Menominee MI 49858. 906-863-1346.

16' xcription discs; Ampex Q-mat R/P & PB units, vintage. L Houck, Rollin Rcdg, 210 Altgelt, San Antonio TX 78201. 512-736-5483.

Prod library with 220 10" recs, 78 rpm discs, 75 percent mint condition, \$300/BO + shipping & handling. M Kuehl, Passage Productions, 1418 N Stevens, Rhineland WI 54501. 715-369-4007.

Ampex 456 (2) 2" mastering, used once, \$70 ea. D Lundy, 606-546-6650.

Pams Jingles ref tapes, 1951-1976, BO. R Kaufman, Pams Prods, POB 462247, Garland TX 75046. 214-271-7625.

Want To Buy

Tascam 32/34 Mdls RTS-14/15. S Keefe, WCNI, CT College, New London CT 06320. 203-447-1296.

Classic R&B top 20 hits from 60s/70s/80s, black artists only; cassettes/albums/reels. F Smith, 615-624-7126.

We pay 50 cents to \$100 per record for 45's & LP's from 50's & 60's, nice cond only, rock/country/blues. B Berry, Karavan Bdcg, 13 Montgomery Pl, Conroe TX 77284.

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Eng student desiring donation of old bdcst equip (anything) in repairable cond, will pay all shipping charges, EE student at Purdue. C Gill, POB 371, Indianapolis IN 46206. 317-923-2800.

Monte Vista Christian School, would appreciate any donations of used radio equipment along with used TV broadcast equipment. T Quinn, 408-475-0423.

Ive freq analyzer, \$200/BO; 20A pink noise gen, \$150/BO. J Diamond, Blue Diamond, Box 102C Chubbic Rd RD1, Canonsburg PA 15317. 412-746-3455.

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Want To Buy

Crown RTA2 real-time analyzer; Tek 570 tube curve-tracer; Lambda & HP pwr splys. R Katz, Allegro Sound, 15015 Ventura Blvd, Sherman Oaks CA 91403. 818-377-5264.

TRANSMITTERS

Want To Sell

Power Pak SMX-40 40 W dig, tuned, broad band exciter, \$2500/BO. J Phillips, WZOM, 414 Washington, Defiance OH 43512. 419-782-8591.

CCA FM 40 E 40 W exciter w/manual & test cable, \$1900; McMartin B-910 exciter, \$1000, w/stereo & 57 kHz geners, \$1600. M Benson, KWTY, Box 773, Big Pine CA 93513.

Harris SAW filter bd, \$550; Townsend UHF exciter, \$10K; Townsend Pulser ICPM corr chassis, dual output, \$12200; Harris Visual & LO for aural, UHF, \$5K; Townsend exciter parts. G Kenny, KCL, POB 932, Neosho MO 64850. 417-451-1440.

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Call Dave White 217-224-9600

RCA BTA-500 MX AM, good condition with Kintronics low power, \$500; Collins 21E 5 kW AM, excellent condition, \$1000. Steve, WPRZ, POB 3220, Warrenton VA 22186.

Gates FM 10-G tuned to 99.1 MHz. New final & driver tubes, good condition, priced to sell. Larry or Dave, KMEN/KGGI, 2001 Iowa Ave #200, Riverside CA 92507. 909-684-1991.

Continental 814-C 3.8 kW solid state, FM w/o exciter, excellent cond. S Woodward, WMTY, POB 459, Greenwood SC 29648.

Power Pak SMX-40 40 W FM exciter, BO. J Phillips, WZOM, 414 Washington, Defiance OH 43512.

TTC XLFM xlator w/(2) TVK-1 code ID bds, (2) mod bds for spot injectin, \$200 ea. D Rose, KAAA, 2534 Hualapai Mtn Rd, Kingman AZ 86401. 602-753-2537.

Gates BC-5P2, 5 kW, \$3500; AM & FM rectifiers. 912-922-2222.

BE 5400C-900-5401-001, \$2000; (2) 2100C-900-2111-001, \$750 ea; 2100C-900-2110-001, \$550; Prism dig proc, \$1200. H Gauthier, WSAR, POB 927, Fall River MA 02722. 508-678-9727.

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Energy Onix 3.5 kW FM, 2 1/2 yrs old, \$13500. R Chambers, KSUE, 3015 Johnstonville Rd, Susanville CA 96130. 916-257-2121.

RCA BTA-5L1 5 kW AM, good condition, \$5000. P Patton, WWAM, POB 279, Jasper TN 37347. 615-942-1700.

Collins 20V 1000 W AM with tubes, nice condition, \$1500. R Elm, WWJC, 1120 E McCuen St, Duluth MN 55808.

Gates TE-3 exciter, gd cond, sell/trade; Nautel Ampfet 10 10kW solid state. E Hoehn, KFMZ, 1101 Walnut, Columbia MO 65201.

Continental 814-C 3.8 kW broadband FM, 4 yrs old, \$25K. S Woodward, WMTY, POB 459, Greenwood SC 29648.

Rockwell/Collins 310Z-2 FM with stereo generator & comp STL input cards, little use, mint condition, \$1400. B Watson, KSAK, 3352 Honebrook Way #7, Ontario CA 91762. 714-947-8440.

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| 3.5 kW FM | 1979 Syntronics SI-F-3 | 5 kW AM | 1972 CCA M5000D |
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Xtal for 910 kHz fits Collins 20V, gd cond, \$100/BO. R Miller, KUAU, 490 Ulumalu Rd, Haiku HI 96708. 808-572-5534.

Peter Dahl plate, \$800/BO. P Patton, WWAM, POB 279, Jasper IN 37347. 615-942-1700.

RCA BTA-5H whole/parts, BO. F Santore, WELI, POB 85, New Haven CT 06501. 203-281-9600.

Harris MS-15 exciter modules, AFC & MOD OSC in exc cond, \$150 each. Call 816-635-5959.

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| 5.0 kW | AM | 1990 | Harris SX-5A |
| 15 watts | FM | 1977 | Harris MS-15 |
| 15 watts | FM | 1980 | Versacount V-322 |
| 500 watts | FM | 1983 | QEI 675T500 |
| 1.0 kW | FM | 1970 | Harris 1H3 |
| 5.0 kW | FM | 1975 | RCA BTF-5E1 |
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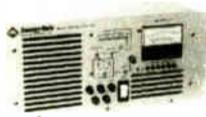
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cond, \$200. G Gabriele, WFOG, 215
Brooke Ave, Norfolk VA 23510.

LPB S-7 (2) 3-spd quick start, blue,
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7788.

JVC 4DD-5 CD-4 quad disc demod,
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751-9346.

Technics SP-25 direct drive, gd cond,
\$250. R Franklin, Franklin Studios,
1004 Dekalb St, Norristown PA 19401.

Gates CB-500 (2) 16" w/Gray tone
arms, exc cond, \$200 ea. R Elm,
WWJC, 1120 E McCuen St, Duluth
MN 55808.

Technics SP-15 (2) w/arm, cart, cov-
ered base & Audiometrics pre amp,
\$500 ea/BO. J Pierce, KWNH, 1515 E
Tropicana Blvd, Las Vegas NV 89119.
702-595-5705.

QRK (2); Rek-o-kut w/mixer, BO.
Mark, 308-382-2800.

Russco (2) Studio-Pro w/Micro-trak
tone arms & carts, \$400 both. D Rose,
KAAA, 2534 Huala Pai Mtn Rd,
Kingman AZ 81401. 602-753-2537.

Technics SP-10 MKII, exc cond w/PS,
copy docs, stand & ATP-12T arm,
\$700. G Foldessy, WAKR, 1735 S
Hawkins Ave, Akron OH 44320. 216-
869-9800.

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Dustin Dr, Wilmington DE 19703. 302-
798-4076.

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VC-40A color camera stereo micro-
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Diamond, Box 102C Chubbic Rd RD1,
Canonsburg PA 15317. 412-746-3455.

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McLean, Stagedoor 1, 9915 MacArthur
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4076.

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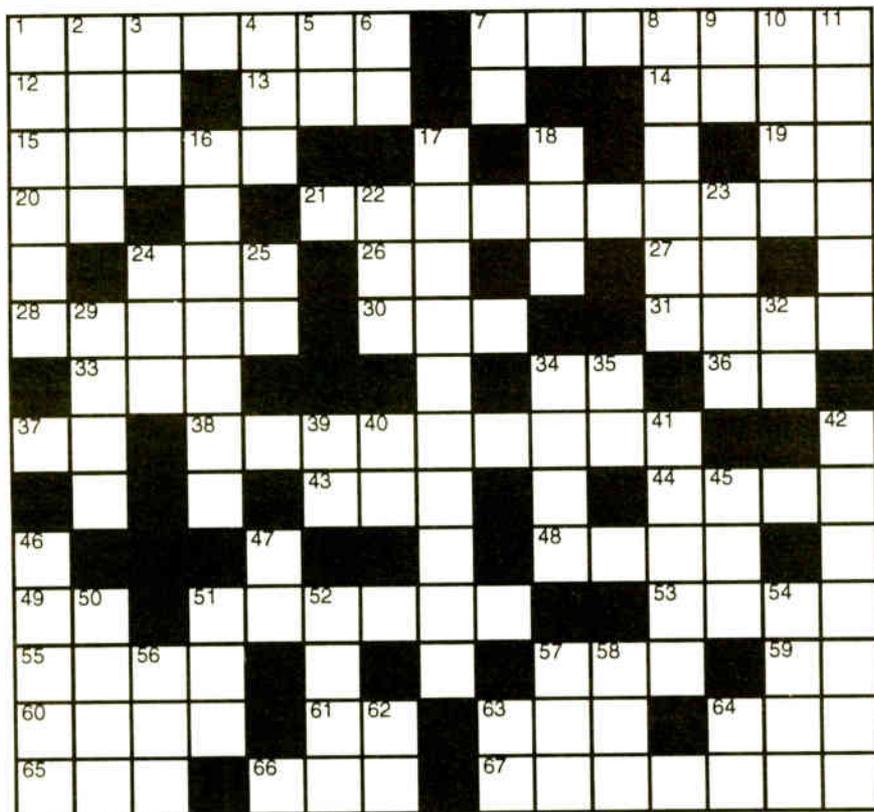
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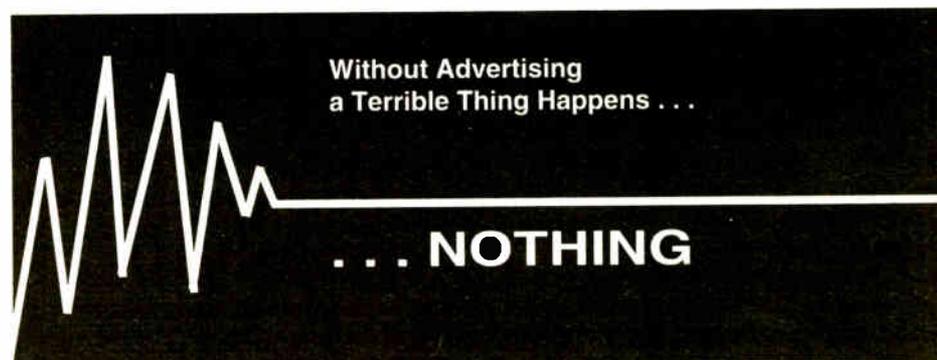
by Steve Walker solution in next issue of RW

Across

1. Digital Inspiration
7. Rolled oats & nuts
12. Initialization file
13. Cocoon
14. Test
15. Altronic Dummy ___ (plural)
19. Designation for wide cart deck
20. Function
21. A-6000 Console
24. Corporate designation
26. We
27. Suffix used to form agent nouns
28. "It thinks it's a cart machine"
30. Squeeze more out of something
31. Assign value to
33. Original equipment mfr.
34. Element #26
36. Luxury
37. Upon
38. "Just right!"
43. Cyclic Redundancy Check
44. Indian tribe
48. Noise; heavy landing
49. Direction
51. Speak easy
53. Complete turn-key tower systems
55. Close to
57. Article
59. Branch of computer research
60. ___, alt, delete
61. Exclamation
62. Flying insect
64. Lighter
65. Cable sports network
66. Mix 'n Match
67. Bleepers

Down

1. Steal in small quantities
2. Soon (archaic usage)
3. Government bureau created in 1947
4. Foot-pound-second
5. Input/Output
6. Music Disc
7. Type of doctor
8. To "fix" an animal
9. Beast of burden
10. Yard
11. Current measure
16. Broadcast Products by Fidelipac
17. "Digital automation that makes sense" (2 wds.)
18. DigiCenter developer
22. ___ and cry
23. Of the mouth
24. Disk drive interface
25. Connecticut
29. "Who said a workhorse can't be a thoroughbred?"
32. Super Bowl Champ St.
34. To be anxious
35. And (Lat.)
39. District of Columbia
40. Infrared radiation
41. "If it Works, Don't fix it"
42. What made the six million dollar man tick
45. Security chief on DS9
46. Noontime meal
47. Muscial note "C"
50. Animals kept for pleasure
51. Signature Sereis processor manufacturer
52. "More Power to You"
54. Famous musical
56. Equal to 100 Sq. meters
57. Golf apparatus
58. Layer
62. Hello
63. British Columbia
64. ___ Jackson



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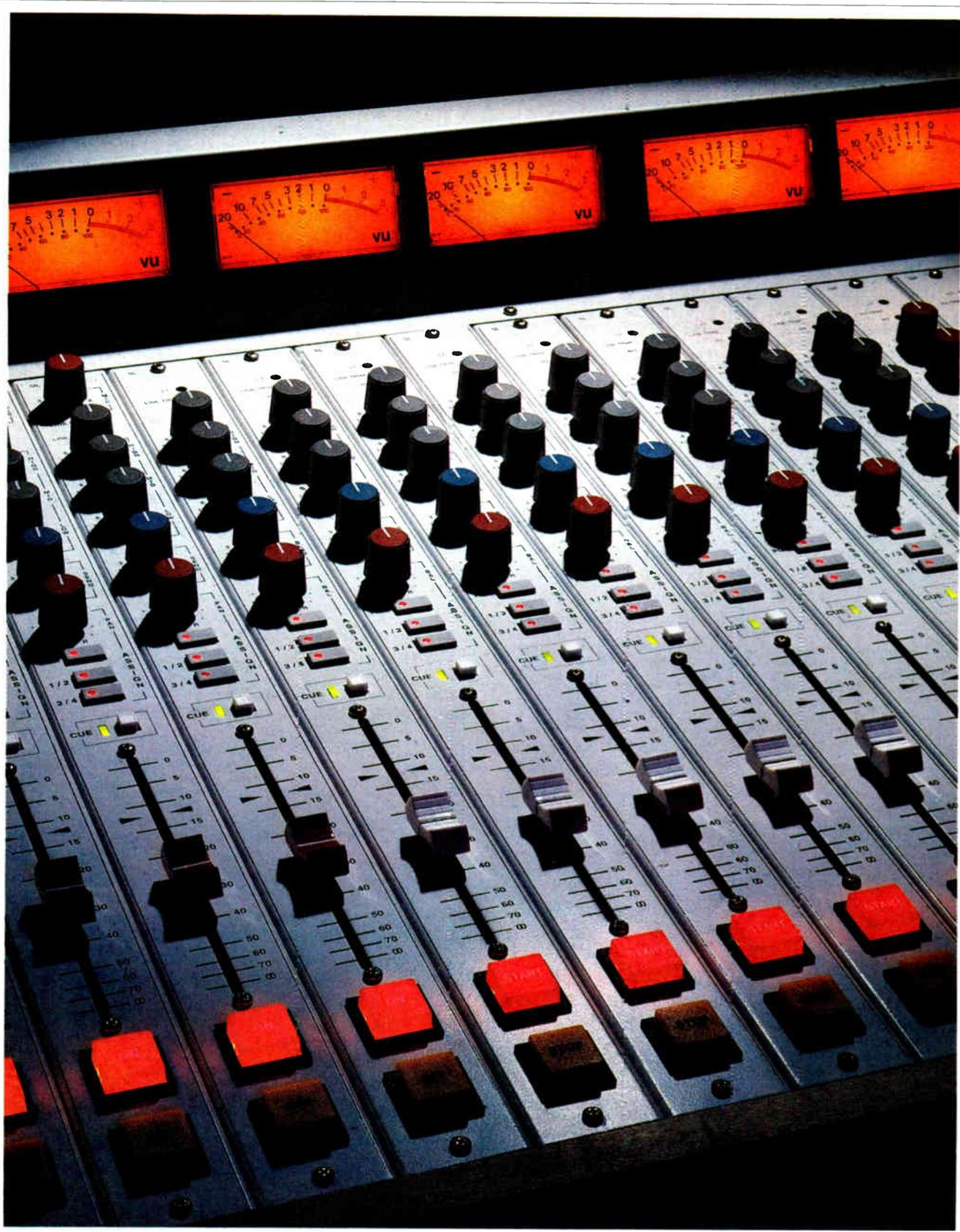
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mixes; and of course, an equalizer option for your production suite. You can even add features later; you can relocate any module anywhere in the mainframe at any time, preventing obsolescence as format needs change.

And while Wheatstone is well known for superior technical performance, the A-6000 surpasses even our own previous consoles in virtually every measurement category.

The A-6000 has the appearance, features and power to excite the most demanding program and production staff; its engineering, performance and thoughtful design will help your technical staff achieve excellence. So contact Wheatstone, the people with knowledge, experience and a commitment to excellence.



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A-6000

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Circle 177 On Reader Service Card

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